CHAPTER III EFFECTS OF IMPLEMENTATION

INTRODUCTION

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This chapter provides a summary of the key environmental effects of the alternatives as described in the specialist reports prepared for this project. The analysis and conclusions about the potential effects are synopsized and cited in the respective resource sections. The Resource Specialist Reports, which disclose the full analysis of the direct, indirect, and cumulative effects, are incorporated by reference and are available in the project file, located at the Sullivan Lake Ranger District Office in Metaline Falls, Washington. This document incorporates by reference the recommendations from the Lost Granite Squirrel Roads Analysis Report, which was compiled by members of the core interdisciplinary team. This assessment of effects assumes compliance with standards and guidelines established in the Colville National Forest Land and Resource Management Plan (Forest Plan), Regional standards, State and Federal laws, and National policies. The analysis was based on following regulations and requirements found in the Healthy Forest Restoration Act, the 1960 Multiple-Use Sustained-Yield Act, the 1976 National Forest Management Act, the Organic Administration Act of 1897, the Aquatic Conservation Strategy/Inland Native Fish Strategy (INFISH), and the Direction for Neotropical Migratory Landbirds. These standards, guidelines, policies, and laws provide measures which minimize and sometimes avoid adverse impacts, and require rehabilitation of resources affected by Forest programs. The summary of effects of all the alternatives is listed by resource and the discussion centers on effects that are direct, indirect, or cumulative. These impacts can be either beneficial or adverse.

The consequences of implementing each alternative are summarized in terms of changes in the affected environment from the current situation. Forest Service Handbook 1909.15, Environmental Policy and Procedures Handbook (USDA Forest Service 2004), identifies a list of environmental factors to be considered in data collection and environmental analysis. Factors which would not be affected by the proposed activity and were considered not relevant in comparison of alternatives are: American Indian rights (AIRFA), consumers, civil rights, minority groups, and women. The area does not contain, nor is it adjacent to, prime range, or farmlands. The alternatives were assessed to determine whether they would disproportionately impact minority or low income populations, in accordance with Executive Order 12898. No local minority or low-income populations were identified during scoping or effects assessment. No minority or low-income populations are expected to be impacted by implementation of any of the alternatives. All past, present and reasonably foreseeable actions, both federal and non-federal, were researched and considered by the specialists in their reports (for more detail see appendix C).

This project is not adjacent to, nor would it have any effect on, existing wilderness areas, Forest Plan designated roadless areas, or Research Natural Areas. This project would have no effect to designated recovery area for grizzly bear, woodland caribou, gray wolf, or priority bull trout habitat.

Fire/Fuels (Purpose and Need Objective #1)

Fire is a primary disturbance mechanism that has shaped the Misery Lake analysis area for centuries. Fire has maintained and provided several critical functions in the ecosystem, including promoting structural and species diversity, the regulation of plant succession and regeneration, moderation of fuels and biomass, control of insects and disease populations, and the maintenance of biological and biogeochemical processes (Crutzen and Goldammer 1993, Keane et al. 2002). Since the early settlement period of the early 1900s, fire exclusion has been a leading cause of alteration in many of these key functions within the analysis area.

Observations from aerial photographs from the 1930s to 2000 suggest that fire exclusion has dramatically altered the composition and structure of the analysis area. Two primary effects of fire exclusion can be observed in the compositional and structural attributes of the landscape and the stand: *afforestation*, and a species compositional shift. *Afforestation* is the establishment of forested lands in an area that was not historically forested, or is the process by which biomass increases beyond the historic range of the site.

The second major observed effect of fire exclusion is the shift in species composition away from dominance in fire-*resistant* species (ponderosa pine and western larch) to a substantial increase and co-dominance of fire-intolerant species, primarily western red cedar, and grand fir. These shifts have significantly affected the warm-dry stand types with a relatively dense mid and understory component of grand fir, Douglas-fir, and western red cedar.

Changes to risk of large, stand-replacing fires and fuel levels was measured using Fire Regime-Condition Class and crown fire potential.

Fire Regime-Condition Class (FRCC)

The Fire Regime-Condition Class (FRCC) is used to describe the degree of departure from the historic fire regimes that results from alterations of key ecosystem components such as composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, high-grade timber harvesting, grazing, introduction and establishment of non-native plant species, insects or disease (introduced or native), or other past management activities. Table 4 describes the attributes of each FRCC.

Table 4. Fire Regime Condition Class Attributes

Condition Class	Attributes
Condition Class 1	• Fire regimes are within or near their historical range. • The risk of losing key ecosystem components is low. • Fire frequencies have departed from historical frequencies (either increased or decreased) by no more than one return interval. • Vegetation attributes (species composition and structure) are intact and functioning within their historical range.

Condition Class	Attributes
Condition Class 2	• Fire regimes have been moderately altered from their historical range. • The risk of losing key ecosystem components has increased to moderate. • Fire frequencies have departed from historical frequencies by more than one return interval resulting in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape pattern. • Vegetation attributes have been moderately altered from their historical ranges.
Condition Class 3	• Fire regimes have been substantially altered from their historical range. • The risk of losing key ecosystem components is high. • Fire frequencies have departed by multiple return intervals resulting in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape pattern.

FRCC was determined using LANDFIRE – Landscape Fire and Resource Management Planning Tools Project (www.landfire.gov). The specific products used for this assessment were derived from satellite imagery on 30-meter grid spatial resolution. It is important to note that the FRCC is highly variable across the Misery Lake analysis area; as with vegetation structure and composition, minor changes in slope, aspect, or topographic position can have dramatic effects on the vegetation potential of the landscape. LANDFIRE imagery, a tool designed for landscape scale assessment does not always identify this variability at the project scale.

The majority of the analysis area is best described as FRCC 2 (95%), found mostly in the *mixed severity* western larch, grand fir, Douglas-fir, lodgepole pine and western red cedar community types. Stand structure is largely multi-strata[19], intermixed with relatively dense single strata stands of lodgepole pine and Douglas-fir. Fire frequencies have departed from historical frequencies by more than one return interval resulting in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape pattern. Vegetation, structure, and composition have also been moderately altered from their historic range (i.e. increasing ladder fuel component composed of fire-intolerant species).

Approximately 1% of the analysis area is categorized as FRCC 1, *mixed severity* (Fire Regime III), and 4% of the analysis area is categorized as 'Other' which includes non-forested sites such as water, urban and agricultural areas. See Table 5 below.

[19] Strata are the layers or levels of stand structure, such as trees, shrubs, non-woody vegetation (grass and herbs), dead woody, litter/lichen/moss, and ground (duff).

Table 5. Fire Regime Condition Class (FRCC) for The Misery Lake Analysis Area.

	Condition Class		
Fire Regime	**1**	**2**	**Total (Acres)**
I		3,523	3,523
III	141	7,751	7,892
IV		2,114	2,114
Total (Acres)	**141**	**13,388**	**14,093**[20]

Effects of Alternative A

Alternative A is the no action alternative. Taking no action would result in no improvement in stand vigor and related forest health. *Afforestation,* inter- and intra-stand stocking levels and crown fire potential would continue to increase. No acres would be treated adjacent to the Blue Slide community, and would, therefore not meet the objective of meeting the goals of the Pend Oreille County Community Wildfire Prevention Plan. No priority stands would be treated to manage fire risk.

Effect on Fire Regime Condition Class (FRCC)

The shifts in composition away from the more open forest environment under the no action alternative would continue to stress the overstory fire-tolerant cohorts, and (at the landscape scale) would *not* move FRCC 2 stands to the FRCC 1 target (see Table 6 below). Overall, the drier stand types would continue to gain biomass and the understory cohorts would greatly increase ladder and crown fuel connectivity. A no treatment alternative would continue with fire exclusion as the dominant human-caused disturbance on the landscape. Existing stand conditions suggest a significant amount of the land area in the drier forest types is in a higher condition class than identified by LANDFIRE imagery. Due to afforestation and in-growth of primarily fire intolerant trees there is a relatively high conifer stocking creating high connectivity of both ladder and crown fuels. Over 1/3 of the stands surveyed are indicative of FRCC 3 with a relatively high crown fire potential.

Effect on Firefighter and Public Safety

Under the no action alternative, fuels accumulations would continue to shift away from light, fine fuels and grasses (fuel model [FM][21] 2/9) to a condition favoring high levels of coarse woody debris, litter, duff, and ladder fuels (FM 10). During a wildfire event, higher fuel loads and crown fire hazards would increase fire suppression costs and the associated risks to both firefighters and the public.

Effects of Fuels Treatments on the Residual Overstory

Under this alternative no fuels treatments would occur and no mortality would occur as a result of either mechanical fuel reduction or prescribed burn treatments.

Effects of Alternative B (Proposed Action)

This alternative proposes both mechanical and prescribed fire treatments within an area immediately adjacent to the communities around Blue Slide, which was designated as priority number 1B under the Pend Oreille County Community Wildfire Prevention Plan. Two thousand eight hundred and fifteen acres are proposed for commercial harvest. Of this total 1,390 acres are proposed for jackpot and/or underburning, and 1,425 acres are proposed for mechanical fuels treatments such as mastication and/or machine piling. In general, units prescribed for underburning contain a high percentage of fire-tolerant trees (i.e. western larch, ponderosa pine, Douglas-fir)

[20] Includes 564 acres of non-forested area.

[21] FM – Fuel Models are based on ground cover conditions (i.e. grass, shrubs, slash or other timber litter), and the amount of ladder fuels creating connectivity to the canopy, that describe fire hazard potential.

while units prescribed for mechanical fuels treatments contain a high percentage of fire *intolerant* trees (i.e. lodgepole pine, western redcedar, western hemlock, grand fir).
Up to 6,197 acres are proposed for noncommercial treatments. Of this total 4,380 acres are proposed for jackpot and/or underburning; and 392 acres are proposed for mechanical fuel reduction treatments and underburning.

The objectives of these treatments are to:

1. Reduce the threat of severe wildfires within the Misery Lake area,
2. Reduce accumulated surface, ladder and crown fuels,
3. Improve Fire Regime Condition Class (FRCC); move stands from Condition Class 2 and 3 to Condition Class 1 and 2,
4. Promote the stocking of fire-tolerant conifer species such as western larch, Ponderosa pine and Douglas-fir,
5. Stimulate the growth of hardwood species upon which wildlife depend, such as aspen, birch and redstem ceanothus, and
6. Maintain and/or encourage old-growth habitat of fire dependent ecosystems.

Table 6. Crown Fire Potential for The Misery Lake Analysis Area – Comparison of Alternatives.

	Crown Base Height (ft)	Torching Index[a] (mph)	Crowning Index[a] (mph)
Alternative A: No Action[b]	22	42	21
Alternative A: No Action[c] Stands with ***passive*** or ***active*** crown fire potential	2	2	5
Alternative B: Proposed Action[c] Stands with ***passive*** or ***active*** crown fire potential	71	101	70
Alternative B: Proposed Action[b]	71	101	70

[a]Modeled at the 90th Percentile Weather
[a]Lower Torching and Crowning values indicate higher susceptibility to crown fire initiation and spread
[b]Fuel Survey data summarized from approx 175 stands (3,100 acres, or all stands sampled within the analysis area)
[c]Fuels Survey data summarized from approx 60 stands (1,100 acres. These stands are a subset of the 3100 acres listed above, or only stands with passive or active crown fire potential)

The proposed action should substantially reduce the risk to both crown fire initiation and crown fire spread. Alternative B proposes treating approximately 1,100 acres with high crown fire potential. Treatment of these stands complement areas of private ownership identified by the Pend Oreille County Wildfire Prevention Plan as priority for treatment.

Torching index is used to compare effects of potential treatments. The index estimates the wind speed needed to initiate and sustain a crown fire. As modeled, the torching index for Alternative B should increase from 42 to 101 miles per hour (mph) and the crowning index should increase from 21 to 70 mph. Within the stands

identified with a high crown fire potential, the torching index should increase from 2 to 101 mph and the crowning index should increase from 5 to 70 mph.

Effect on Fire Regime Condition Class (FRCC)

Underburning is proposed for 6,115 acres (approx 62% of NFS ownership within the Misery Analysis area). These treatments are expected to reduce surface and ladder fuels biomass within the drier stand types and (at the landscape scale) should move FRCC 2 and 3 stands to the FRCC 1 target. Subsequent regeneration should also shift to a more fire-tolerant cohort.

Fuels reduction through burning or mechanical treatment should result in a more open canopy capable of supporting fine fuels complexes of pinegrass, light timber-litter, and shrubs. Overall, this should improve forage quality for wildlife, minimize shade-tolerant encroachment, and promote a fire-tolerant overstory. Historically, wildfires burned on the drier sites every 15-20 years, in patches ranging from 200–500 acres in size (Shellhaas 2000a and 2000b). With 70-80 years of fire exclusion, it may require several mechanical treatments and/or subsequent prescribed burns to successfully restore this area to its historic FRCC.

Effect on Firefighter and Public Safety

Fuels reduction treatments as proposed under the proposed action should reduce fuel loads and crown fire hazards and thus decrease fire suppression costs and the associated risks to both firefighters and the public.

Effects of Fuels Treatments on the Residual Overstory

Mechanical and prescribed fire treatments should reduce fuels from a timber-litter, ladder fuel, down-woody model (FM 10) to a more open, timber-litter model (FM 2/9). Depending on the residual overstory component, it should be assumed that ~20% of the basal area of residual trees (particularly Douglas-fir) may die in years following prescribed burning. This assumption is based on experience and the first order fire effects model (FOFEM[22]). Residual trees may also be pre-disposed to fire mortality due to drought, competition, and/or insects and diseases.

Cumulative Effects

Implementation of Alternative B, combined with past and proposed activities on the adjacent ownerships, is expected to reduce the potential for severe, large-scale wildfires within and adjacent to the Misery Lake project area.

Air Quality

The existing sources of particulate emissions within and/or near the Misery Lake analysis area include smoke from neighboring prescribed fire projects, including but not limited to forest residue burning on NFS and non-NFS ownerships; smoke from residential wood stoves and agricultural activities in the Pend Oreille valley (Blueslide, Tiger, Ione areas); and vehicular dust and exhaust.

Effects of Alternative A

The potential for significant air quality degradation would increase in the long-term under this alternative. Without vegetative and surface fuel treatments designed to mimic the historical fire regimes, the trend would be for a large portion of the Misery Lake landscape to be at high risk to uncharacteristically severe wildfires. Consumption of relatively high levels of surface fuels and forest biomass during severe wildfire events could produce smoke emissions far greater and longer than historical norms.

Effects of Alternative B

Smoke has adverse effects on human health, affects visibility, and is otherwise a nuisance to humans. Current direction to protect and improve air quality on National Forest System (NFS) ownerships is provided by: 1) The Forest and Rangeland Renewable Resources Act of 1974 (16 USC 1601), as amended by the National Forest Management Act (16 USC 1602); 2). The Federal Land Management Policy Act of 1976 (43 USC 1701); and 3) The Clean Air Act amendments of 1977 and 1990 (42 USC 7401-7626). The Clean Air Act is administered

[22] FOFEM - a computer program developed to meet the needs of resource managers, planners, and analysts in predicting and planning for fire effects.

jointly by the Environmental Protection Agency (EPA) and their designated state regulatory agencies. Three elements of the Clean Air Act generally apply to land management activities that produce emissions (1) Protection of National Ambient Air Quality Standards (NAAQS), (2) Conformity with state implementation plans; and (3) Protection of visibility in Class I airsheds.

The EPA sets limits on how much pollution can be in the air through the NAAQS. Areas that are in violation of the NAAQS may be designated as a non-attainment area by the EPA. Non-attainment status has numerous implications for an area, including increased controls and limitations on the sources and amounts of emissions allowed. Non-attainment areas that are relatively close to the Misery Lake analysis area include Sandpoint, ID, located approximately 45 miles to the southeast, Spokane, WA, 55 miles to the south, and Pinehurst, ID, 85 miles to the southeast.

Class I and II airsheds are also regulated by the EPA and their designated state regulatory agencies. Class I airsheds include all International and National Parks greater than 6,000 acres in size, National Wilderness Areas greater than 5,000 acres, and other areas as designated by the EPA. Class I airsheds that are relatively close to the Misery Lake analysis area include the Cabinet Wilderness, located approximately 90 miles to the east, the Pasayten Wilderness, 220 miles to the west, and the Spokane Indian Reservation, 80 miles to the southwest.

The Misery Lake analysis area is within a designated Class II airshed. Smoke originating within and/or potentially impacting this airshed is regulated by the Washington Department of Natural Resources (DNR) – Smoke Management Division.

The potential for smoke intrusion into a non-attainment area or Class I airshed from proposed activities would be negligible due to distance and the prevailing southwest winds. Smoke and other airborne particulates originating from proposed activities within the Misery Lake analysis area would normally be carried to the northeast, away from Class I airsheds and non-attainment areas.

Smoke from prescribed fire activities may temporarily degrade air quality within the Misery Lake analysis area and nearby Pend Oreille River valley (Blueslide, Tiger, Ione areas). In comparison to scheduled ignitions, unplanned ignitions (i.e. wildfires) can result in smoke emissions that are larger, occur at the worse times for adequate dispersal, and have greater impacts on areas of human habitation than prescribed fires (Huff et al. 1995). Nevertheless, potential impacts to air quality from prescribed fires would be reduced through techniques that reduce the emissions produced for a given area and by redistributing the emissions through meteorological scheduling and coordination with the WA Department of Natural Resources (DNR).

Proposed activities that would reduce potential smoke emissions over a given area include: 1) Prescribed burning in the spring and to a lesser extent, in the fall when large woody debris and soil and duff moistures are relatively high. Burning when large fuels and organic layers are wet often result in lower large and organic fuel consumption, less smoldering, and a significant reduction in smoke emissions (Ottmar et al. 2001); 2) Prescribed burning when conditions favor the optimum combustion of the 1, 10 and 100-hour targeted fuels (i.e. slash and woody debris under 3” diameter); and 3) Selective removal of the 1,000 and 10,000-hour fuels such as pulp, roundwood and sawlogs.

Meteorological scheduling is often the most effective way to minimize direct smoke impacts to the public (Ottmar et al. 2001). Prescribed burns would be scheduled and approved by the WA DNR during periods of good atmospheric dispersion (dilution), and when prevailing winds are forecasted to transport smoke away from sensitive areas (avoidance). In addition, total emissions from proposed activities would be spread out over a three to five year implementation period.

Along with existing airshed pollutants, smoke from prescribed fire activities may cumulatively degrade air quality within the Misery Lake analysis area and surrounding Pend Oreille River valley. Coordinated meteorological scheduling would be used to regulate all prescribed burns within the regional area, thus minimizing the potential for cumulative smoke impacts to the public. Prescribed burns would be scheduled and approved by the WA DNR only during periods of favorable atmospheric transport and dispersion. To insure compliance with state and federal air quality standards, approved burning would be determined through monitoring and computer modeling of all scheduled and proposed emissions. For an "average" spring or fall burn prescription, NAAQS for PM10 permit ignition of up to 500 acres of Fuel Model 11/12 (activity fuels) or 750 acres of Fuel Model 2/5/8/9/10 (natural fuels). Historically, less than 100 acres are ignited on the district on a daily basis due to cumulative smoke considerations and/or limited resource capabilities.

PM10- Particulate Matter – a measure of fine particles of particulate matter that come from fuel combustion, agricultural burning, woodstoves, etc. Particulate matter is measured in micrometers (microns). PM10 is all particles less than or equal to 10 microns particles.

Socio-political considerations and/or unfavorable changes in transport winds may necessitate a curtailment in prescribed burning at the local level. This would be determined on a case-by-case basis with a change in forecasted burn conditions communicated to the WA DNR.

The Forest Plan has no special requirements for smoke management beyond those required by the Clean Air Act. Proposed activities meet or exceed the requirements of the Clean Air Act through compliance with air quality standards regulated by the WA DNR. Burn Plans, outlining required weather and fuel parameters for desired fire and smoke effects, would be prepared, and approved for each prescribed burn. Prescribed burning would also be consistent with State laws requiring treatment of activity-created fuels.

Silvicultural Treatments and Forest Health (Purpose and Need Objective #2)

Existing Condition

Plant Associations vary throughout the analysis area with lodgepole pine community type, Douglas fir, western red cedar, western hemlock, and grand fir series represented. Tree species include Douglas-fir, Ponderosa pine, western larch, western white pine, lodgepole pine, western red cedar, Englemann spruce, western hemlock, grand fir, subalpine fir and hardwoods (cottonwood, aspen, & birch). Due to past fire and logging history, large areas of even-aged larch, lodgepole pine, and Douglas-fir exist. These early seral species often occupy the overstory while Douglas-fir, grand fir, western redcedar and western hemlock commonly occupy the understory in the seedling and sapling size classes. The fire origin stands resulted primarily from stand-replacement fires in the 1900s. Stand ages are typically 65 to 85 years for the overstory and 10 to 20 years for the understory. These stands are predominantly overstocked and in the smaller size classes (less than 12 inch DBH[23]). Remnant trees of Ponderosa pine, Douglas-fir, larch, hemlock, and cedar are also present in the overstory. These trees usually occur where more moist conditions or larger, more fire-tolerant trees were present. These remnant trees survived the stand-replacement fires. Past harvest activities in the analysis area have removed some of these remnant trees.

Patches created by root rot over the past 20 to 30 years have been regenerated through natural seeding. Most of the natural regeneration is in shade-tolerant species such as grand fir, western red cedar, western hemlock, and intermediate shade tolerant Douglas-fir. To a lesser extent, especially on south to west aspects some of the regeneration has been shade-intolerant western larch and ponderosa pine. Where existing residuals left by past entries or small patches

There are **seven structural stages (SS)** identified under the Regional Forester's Forest Plan Amendment #2: Revised Standards for Timber Sales on Eastside Forests (Lowe, 1995), also known as the "Eastside Screens". All structural stages are represented in varying proportions in the watershed. Structural stages 1, 2 and 3 are considered an early structural stage of stand development. Structural stages 4 and 5 are considered a middle structural stage. Structural stages 6 and 7 are considered late or old structural stages. Variations in structural stages are a result of fire, insects, diseases, harvest disturbances, weather (precipitation level, wind, etc.), and stand development.

[23] Diameter at breast height, or 4.5 feet above ground level on the uphill side of the tree.

created by root rot (primarily *Armillaria*) are providing shade to the natural regeneration, the shade tolerant species are beginning to over-top the shade-intolerant regeneration.

Past harvest activity that removed the overstory and retained the suppressed understory has left stands that are stagnated and genetically inferior to the original stand. These stands may never reach late and old structural stages without a disturbance event.

Fire exclusion and suppression in Douglas-fir and grand fir climax forests has perhaps been the single greatest detriment to landscape diversity (Hessburg and others, 1994). Allowing forest fuels to accumulate due to fire suppression would lead to severe, uncontrollable fires that threaten watershed, wildlife habitat, and scenic resources along with forest residential areas (Everett, 1994).

A full range of insect and disease concerns are present and these are complicating factors for management of Management Area (MA)-5 (Scenic/Timber emphasis), MA-6 (Scenic/Winter Range emphasis), MA-7 (Wood/Forage emphasis) and MA-8 (Winter Range emphasis). Each management area's emphasis and attainment of the management goal can be detrimentally impacted by poor stand vigor from overstocked conditions and the related impending increased insect and disease activity.

The highest priority for treatment at this time are those stands which are developing the combination of species, age, size and vigor which make them susceptible to attacks by insects and/or diseases. Decreases in growth rates indicate decreases in vigor and increases in susceptibility to attack. Radial growth rates greater than 15/20ths of an inch for a 10-year period indicate vigorous, resistant trees. Growth rates less than 10/20ths of an inch indicate slowing vigor and increasing risk of successful attack by various pathogens. Opportunities within the analysis area include reducing stocking and competition to increase the growth and vigor of the residual stand, remove brood trees to reduce the Douglas-fir beetle or mountain pine beetle populations and retain early seral species such as ponderosa pine, western larch and western white pine which are less susceptible to *Armillaria* root rot, mountain pine beetle and Douglas-fir bark beetles.

Effects of Alternative A

Alternative A is the no action alternative. This alternative would result in no improvement in stand vigor and related forest health or moving the stands toward target condition on Forest Service administered lands. Stagnated stands within the proposed project area left untreated would lack adequate crown and diameter development. Structural development would be delayed due to the suppressed or non-existent understory. No treatment would also delay moving stands toward the historical range of variability especially in stands that would be treated to move towards structural stage 6 or 7. In treatment areas that have the potential to be moved toward structural stage 6 or 7 encroachment of more shade-tolerant species have created a hazard due to the increased fuel loading and ladder fuels. Stands would continue to be a high risk to stand-replacing fires. If a fire was to occur many of the preferred early seral leave trees i.e., western white pine, western larch, and ponderosa pine may be killed by the fire and the site would be delayed in moving towards stage 6 or 7. Natural fires may or may not burn under conditions that would thin out the smaller trees and would have limited control over residual tree spacing and species selection. High intensity fires can reduce soil productivity drastically and cause major changes in the hydrological and erosion processes (Hessburg and others, 1999). Severe fires can also cause stand destruction and create potential brushfields that may last for many years.

There would be no silvicultural treatments to reduce stocking levels and improve stand vigor, or to plant early serals such as white pine, western larch, and Ponderosa pine. Conversion of stands to shade-tolerant species would continue, increasing the future hazard to insects and diseases. This alternative would not treat stands that occur along the urban interface to reduce the risk of insect, disease, or wildfire. Since no harvesting would take place the economic value of the dead and dying trees would not be recovered. There would be no money generated from timber sales to aid in monitoring, stand improvement, wildlife, fisheries, recreation, and fuel reduction projects. Within the next ten-year period the risk of insect outbreak and the risk of increased levels of disease are moderate to high. In the long-term, the risk of insect outbreak in the next ten to twenty years would be approaching high. Forest health would suffer from no treatment.

Effects of Alternative B

Direct Effects - Alternative B would treat as many as 1,296 acres in commercial harvest units that were identified as priority for treatment due to forest health concerns. An additional 1519 acres are identified for treatment to treat fuels or to provide wildlife habitat and/or are low priority but would benefit from some type of silvicultural treatment to improve stocking levels, stand vigor, move the stands toward target condition and towards the historical range of variability of structural stages. Generally, the treatments will favor the retention of larger diameter fire tolerant trees and remove the smaller, less fire resistant trees to increase the overall resiliency of the landscape to large fire disturbances. Marking guides will specify to favor retaining early seral species like ponderosa pine, western larch, Douglas-fir and western white pine, especially in upland areas. However, local areas of western redcedar/western hemlock or grand fir will be retained or favored through management to provide vegetative and wildlife species habitat diversity. High-density stands would be treated to reduce the future hazard of insect and disease outbreaks. Approximately 427 acres are proposed for precommercial thinning and western white pine pruning treatments, and up to 3,183 acres in 55 stands would receive prescribed fire treatment only. The proposed treatments include precommercial, noncommercial, and commercial activities. Overall, up to 6,425 acres in 119 units/stands (about 46% of the project area) are proposed for treatment.

Reducing the stand density levels, species selection and removing brood trees would be better accomplished through harvesting than by using prescribed fire alone. Prescribed underburning and site preparation treatments under controlled conditions would reduce the continuity of fuels and the currently high fuel loads which would reduce the hazard of a stand-replacing fire. The underburning would be accomplished under optimum fuel moisture levels to reduce the impact to the residual stand, protect the soils, maintain fire-tolerant species, reduce fire-intolerant regeneration, and maintain stocking levels. Encroachment of shade-tolerant species could be reduced by repeated, periodic underburnings (see fire/fuels specialist report).

Stands or portions of stands with thermal cover for big-game, which are greater than 3 acres, would not be entered with commercial harvest. These areas in addition to corridors for wildlife, or other stands, which may be deferred from harvest activity in this entry would still be at risk of insect and disease outbreaks. These areas would continue to remain overstocked and at risk for a high-intensity stand-replacement fire.

All of the commercial treatment units have the potential to have a salvage component that can be removed during harvest. Many trees that are alive at the time of designation would be dead or dying at the time of harvest due to agents such as mountain pine beetle, white pine blister rust, root disease, fir engraver beetle, dwarf-mistletoe, Douglas-fir beetle, Indian paint fungus and pini fungus. Most of these trees would have visible signs at the time of their designation to be removed. There is also a component of ponderosa pine in many of the units which were planted off-site[24] in the 1930s and 1940s. These trees have poor vigor and have been dying off in an increasing rate over the last 15 years. In addition, there are pockets of blowdown scattered across the analysis area. Some of these areas are in units and some not. Depending on the situation, some of these trees can be designated for removal, especially if their roots are sprung, but the tree is not yet dead.

Treatments would not occur in actual riparian vegetation but would occur in the upland portion adjacent to the riparian. Treatments within small areas of the RHCAs would increase diameters of leave trees to provide shade and future large woody debris and reduce the short-lived LP component. Other areas would be treated to encourage development of existing advanced regeneration such as Engelmann spruce, redcedar and hemlock (see fisheries biologist report).

This alternative provides for reforestation with western white pine, western larch, and ponderosa pine in the regeneration harvest units. Harvesting some of the dead and dying trees, while still maintaining snags to meet the 100% potential population levels of primary cavity excavators, and thinning to reduce stocking levels would recover some of the economical value of the wood (see economical analysis for more information). This economic return could be used to aid in monitoring, stand improvement, wildlife, fisheries, recreation, and fuel

[24] "off-site" means that the seed source for the seedlings came from an area that was at a different elevation or latitude than the planting site. When the seed source location varies quite a bit from the planting location, the ability of the resulting seedlings to fully function where planted is impaired, and the trees are more susceptible to damage from insects or diseases.

reduction projects. This alternative is estimated to produce 25 million board feet of timber. See appendix A for a list of silvicultural treatments proposed for each area.

Indirect Effects - Treatments along the urban interface would aid in reducing the risk of insect, disease, and fires spreading from Forest Service lands onto private and other ownerships lands. Also these treatments would help to protect the Forest Service lands along the urban interface from these agents, which may spread from private or other ownership lands.

Summary

Under Alternative A, as the no action alternative, future management objectives, such as moving the stands toward structural stages 6 or 7 may not be met. This is due to the increased insect, disease and suppression-caused mortality, reduced diameter growth due to overstocked stands, and the increased fire hazard that would result from not treating priority stands. This alternative also would not treat stands that occur along the urban interface to reduce the risk of insect, disease, or wildfire. This alternative also would not provide treatments to improve the RHCAs. Also there would be no money generated from timber sales to aid in monitoring, stand improvement, wildlife, fisheries, recreation, and fuel reduction projects.

Alternative B, by providing treatments to stands, produces more stocking level control, increases diameter growth on residual trees to move areas toward desired structural stage, and reduces the number of stands that currently have insect and disease activity, as compared with Alternative A. With this increase in stocking level control, stand vigor and overall forest health would also improve. Also stand movement towards target condition and towards the historical range of variability of structural stages would be accelerated.

When considering the effects of alternative B against the existing structural stages, there would not be any change in the currently identified late structural stage stands, since no harvesting is proposed in these stands within the project area. Alternative B would treat approximately 1,296 acres considered priority for treatment with regards to forest health, and move all treated stands toward a future late structural stage. Alternative A would have no current change in structural stages, and the stands would take longer to reach a late structural stage without some form of a disturbance event.

Alternative B includes treatments along the urban interface to reduce the risk of insect, disease or wildfire spread. Alternative A would not change the situation from the current condition, and fuels would continue to accumulate into the future, especially in stands where a high percentage of the trees are 75+ year old lodgepole pine. These older lodgepole pine stands exhibit the tops breaking out and falling to the ground, the branches breaking off and falling to the ground, or the whole tree is tipping over and falling to the ground, due to poor height-diameter ratios, low live-crown ratios, and damage occurring due to wind breakage.

Cumulative Effects

Analysis of structural stage distribution and species diversity was analyzed at a watershed scale under the Lost Ruby Ecosystem Assessment at the Watershed Scale[25]. That analysis provided a larger, landscape level analysis area that incorporated historic disturbance (primarily fire) sizes. Activities on adjacent ownerships were included in the analysis as those projects can influence risk of insect or disease spread. Past and proposed harvest activities on both private and public lands within the Misery Lake analysis area would generally reduce the risk of insect and disease spread by managing more acres within the analysis area.

Proposed stand treatments on the land managed by the Forest Service within the Misery Lake analysis area would have a positive effect by reducing the risk of the spread of insects and diseases. Treatment of approximately 1,296 acres of priority stands would help in reducing the risk of the insects and diseases originating on public land and spreading to private land or other areas outside the Misery Lake analysis area. The treatments would result in the removal of brood trees that exist at the time of harvest, reduce stocking levels to that which is unfavorable to outbreak initiations, favor species which are more resistant to root diseases, remove

[25] The Lost Ruby watershed is roughly 76,600 acres in size and lies on the western edge of the Newport-Sullivan Lake Ranger Districts. It includes the Ruby, Lost, South Fork Lost, Renshaw, and Big and Little Muddy creek drainages. It encompasses all of the Misery Lake analysis area.

a portion of sources of mistletoe infections, and treat slash which can be a source for certain bark beetle populations to increase.

The Lost Ruby watershed is currently below historical conditions for late and old structure. Projects currently are designed to accelerate the development of late and old structure. Past harvest activities may have not looked at developing these structures and have possibly removed some of them.

Recent projects within the Lost Ruby watershed analysis area such as Old Berry, Mistletoe, Beetle Mania, Seldom Seen, Lost Tiger, Ruby/Rufus, and Browns Lake, have incorporated treatments to protect and develop late and old structure. The proposed Misery Lake project would also have a positive effect on the development of late and old structure. There is currently one other proposed project being planned during the next 5 years within the Lost Ruby watershed analysis area which is called Renshaw. This project would also look at accelerating the development and protection of late and old structure stands and reducing fuels within the wildland urban interface (WUI). The combination of recent projects and proposed projects would have a positive effect on moving the Lost Ruby watershed towards historical conditions for late and old structure.

Noxious Weeds

Existing Condition

The spread of noxious weeds can primarily be attributed to human-caused dispersal such as vehicles and roads (Roche and Roche 1991), contaminated livestock feed, contaminated seed, and ineffective revegetation practices on disturbed lands (Callihan et al. 1991). The introduction of noxious weeds has occurred throughout the Misery Lake project area, especially along travel routes, and areas within the forest that have experienced disturbance from intense recreation, road construction and timber harvest activities. The roadsides, powerline rights of way, and other travel corridors are the primary areas where weeds can be found and also sources of spread.
A large variety of noxious weeds are found in the Misery Lake analysis area. Documented weed infestations within the project area are addressed in the Colville National Forest Environmental Assessment for Integrated Noxious Weed Management.

The highest priority weeds for treatment are labeled by the Washington State Noxious Weed Control Board as "Class A" weeds and control is required and enforced. Treatment priority is next focused on "Class B designate" species where control is also required and enforced. Then would be "Class B non-designate" species, which are weeds that must be controlled if found in vehicle corridors, buffer strips, and areas of limited distribution. Control of "Class B non-designate" species is also encouraged in areas of large infestations. The least focused on Species for control are "Class C" species.

"Class A" and "Class B-designate" weeds are relatively uncommon in Pend Oreille County and have not been observed within the boundary of the Misery Lake project. Eradication of these weed classes appears to be a reasonable goal. "Class B and "Class C" weeds are common, and the goal is control on rights-of-way with the overall goal of containment. Table 7 shows the weeds present in this analysis area, and their class category.

Table 7. Noxious Weeds in The Misery Lake Analysis Area

Category	Weeds
A	None
B-designate	None
B	spotted knapweed dalmation toadflax yellow hawkweed orange hawkweed oxeye daisy sulfur cinquefoil houndstongue

Category	Weeds
C	Canada thistle reed canary grass common St. Johnswort (also known as goatweed and Klamath weed) common tansy

Effects of Alternative A
Noxious weeds would likely continue to exist on the landscape within the Misery Lake analysis area because of a variety of uses that would continue to occur in the area such as riding off-highway vehicles, driving, hunting and cattle grazing to name a few. The Forest would continue to inventory and treat infestations of noxious weeds to the best of its ability based on its current and future capabilities.

Based on current trends and the Colville National Forest's ability to treat noxious weeds it is expected that most noxious weed species would likely increase slightly within the project area, despite the Colville National Forest currently treating noxious weeds that occur.

Effects of Alternative B
Alternative B consists of a host of vegetation treatments and fuel disposal methods that are expected to reduce the build-up of natural forest fuels and provide for improved forest health within the project area. Vegetation treatments consist of commercial thinning, commercial thin/shelterwood, selection harvest, selection harvest/shelterwood, and shelterwood. Fuel disposal methods consist of underburning, and mechanical fuels treatments.

The end result of alternative B would be a timber stand that is more open with less biomass in the understory. Creating more open stands where sunlight could reach the ground would provide a more favorable environment for noxious weeds to become established and spread. Many noxious weeds are out competed by native vegetation in shaded environments, but it is anticipated that the thinning treatments would not provide enough shade in most areas to deter noxious weed establishment and spread. Disturbed areas would likely be at moderate risk for noxious weed infestation if seed sources are present and readily available. Timely implementation of mitigation measures could likely reduce this risk to acceptable levels.

Soil Disturbance
Soil disturbance facilitates the establishment of new plants, both natives and weeds. Weeds tend to outcompete natives by using water earlier in dry plant associations, or growing and reproducing more quickly in moister plant associations. The playing field can be substantially leveled by aggressively seeding disturbed soil to desired vegetation as soon as feasible and by watching for and treating weeds as soon as they can be detected.

Road Construction, Reconstruction and Closures
New road construction, road reconstruction, and road decommissioning produce areas that likely have the greatest risk for noxious weed establishment. These activities create extensive and often continuous areas of disturbance where nearly all native vegetation is removed and mineral soil is left exposed without desirable vegetation to colonize the area. Disturbed areas create a seedbed readily susceptible to noxious weed invasion. Within the Misery Lake project area, there is an anticipated 33.6 miles of road work, which has the potential to become infested with noxious weeds.

Since noxious weeds are often spread by motorized vehicles, effective road closure, and/or decommissioning are very important in limiting the extent of noxious weed infestations. Temporary roads and those scheduled to be decommissioned and/or closed would need to have effective closure methods employed to ensure that general vehicle traffic cannot access these areas. If roads do not have effective closures in place that effectively limit motorized access, these types of roads and the areas they service have the potential to become infested with noxious weeds.

Treating noxious weed infestations along Forest roads within, and leading to, the project area would greatly reduce the amount of noxious weed seed that would be available to germinate in areas of soil disturbance.

Treating noxious weeds prior to ground disturbing activities would result in their seed and reproductive parts not being transported by vehicles and equipment involved in road construction and vegetative treatments.

Monitoring and post-project treatments would help to prevent noxious weeds from becoming established in the project area as a result of the project. This should occur until revegetation efforts have been determined to be successful.

Requirements[26] to clean equipment prior to entering the project area, use rock sources that are free of noxious weed seeds, seed disturbed areas, and treat existing noxious weed populations, would reduce existing populations and prevent implementation of this project result in introduction of new weed species.

Aggregate and Borrow sites

There are no existing aggregate/rip rap sources within the project area. Two rock sources are found near the project area, but outside of the boundaries. There are four potential new aggregate/rip rap sources within the Misery Lake Project area. Since the material from these sources would be removed and relocated to many of the forest roads in the project area, there is potential risk to spread noxious weed seeds to areas that are currently free of noxious weeds. These potential aggregate sources have not been surveyed for the presence of noxious weeds. Should noxious weeds be present, compliance with management practices 3.9 and 30.3 of the Colville National Forest Weed Prevention Guidelines, as modified by *Preventing and Managing Invasive Plants* Forest Plan Amendment Standard #7, would reduce the risk of spreading noxious weed seeds to road corridors within the project area.

Fire

Prescribed burning at low to mixed-severity would be used in many of the areas within the project area. Fire creates favorable short-term conditions for weed establishment because the results are a prepared seedbed, reduced competition from native plants, and increased nutrient supply (Asher, J. et al 1999). Biennial and perennial weeds already present in the area commonly sprout from buds or crown and often resprout and set seed very quickly after fire. If fire effects are kept in the low severity category so that there is minimal loss of duff and shade and crown-sprouting natives are not killed, weed invasion would be less than in areas burned in the mixed severity category. Both low and mixed severity prescribed fire would result in less weed invasion than high-severity burns that are likely to result from wildfire.

A substantial risk of spread of some weed species would result from prescribed burning. The risk of weed spread in susceptible habitat proposed for burning would vary for different plant associations and different levels of ground disturbance. Those areas where shrub species are predicted to dominate would be at lower risk, while grass and forb-dominated communities would be at higher risk for weed invasion. Drier sites in the project area are particularly vulnerable to expansion of existing populations of goatweed following timber harvest and burning. There would be an increase in the risk of spread of red and yellow hawkweed from existing infestations, particularly in the moister plant associations where canopy cover would be reduced.

Fire also presents opportunities to control the weeds that are already present because they can be seen and treated with various control methods much more easily when the surrounding vegetation is removed. Pre-treatment of existing populations before prescribed burning would reduce the number of propagules available to colonize burned areas. Prompt inspection, and treatment if necessary, following burns would effectively limit establishment of new weeds and control populations of existing weeds. The same factors listed above also promote establishment of native plants, which would grow vigorously if competition from invaders is controlled. Areas adjacent to roads and known weed populations, even when pretreatment is used, would be seeded following the burn with desired vegetation to take advantage of the good establishment conditions created by the fire.

At the same time, treatment of fuels under alternative B would reduce the intensity of future wildfires. This would lower the long-term risk of weed spread into severely burned stands. Also, in low to mixed severity

[26] A list of treatments can be found under Design Requirements in Chapter 2.

burned stands, existing weed populations or new invaders would be easier to spot and treat mechanically or with herbicides because they tend to sprout earlier than native vegetation and grow quickly.

Cumulative Effects
Noxious weeds have occurred within the project area for many decades and the Forest has been treating noxious weed populations in the area since approximately 1992. New noxious weed threats continue to advance onto Forest Service lands as they have for many decades and the Forest continues to treat these areas based on priority. Noxious weed populations are continually evolving because of species that are new invaders becoming established and the transporting of noxious weed reproductive parts which allows for the infestation of other areas.

There have been and will continue to be harvest activities, recreational use, livestock grazing, prescribed burning, wildfire, noxious weed treatments, road decommissioning, road maintenance and mining in the foreseeable future on National Forest System and adjacent ownerships.

The activities in Alternative B would not cumulatively negatively affect noxious weeds within and/or below the Forest Boundary. The acres of noxious weed infested areas are not likely to increase substantially as a result of the project. Alternative B would comply with the *Colville National Forest Weed Prevention Guidelines*, the *Colville National Forest Seeding and Planting* Guide, the *Pacific Northwest Invasive Plants Program Final Environmental Impact Statement* and *Record of Decision,* and the *Colville National Forest Integrated Noxious Weed Treatment Environmental Assessment*. Therefore, the overall risk of the Misery Lake project substantially increasing noxious weed distribution and creating long lasting noxious weed related impacts is low. Though there would be approximately 375 additional acres of ground disturbance produced by the project, the anticipated increase in noxious weed populations would be adequately managed by following the standards and guidelines in the above-mentioned documents, monitoring recommendations, and mitigation measures.

Management Indicator Species (MIS)
Deer, Elk, Beaver, Pine Marten, Barred Owl, Pileated Woodpecker, Primary Cavity Excavators, Northern three-toed Woodpecker, Blue Grouse, Great Blue Heron, Raptors, and land birds are the management indicators selected for the project based on their association with habitat present in the Misery Lake project area and would be indicators of the project's effects on habitat.

Deer and Elk Winter Range *(Purpose and Need Objective #3)*
Existing Condition
The objective for deer winter range in the Forest Plan (page 4-106) is to "Manage for cover/forage ratios approaching 50:50 dispersed to provide for a maximum utilization of forage." At least 20 percent of the cover component should be thermal cover and the rest can be thermal or hiding cover. The project area contains about 4,979 acres of designated deer winter range (Forest Plan Management Areas 6 and 8). Within these areas, a few stands of shade tolerant trees on more sheltered aspects are providing some thermal cover. The majority of the winter range is providing hiding cover for big game. The best foraging habitats are located in riparian shrub/forb fields, old homestead meadows, recent plantations, and underneath the tree canopies of more open forest stands. Very few acres of discrete upland shrub fields exist in the area.

Table 8 displays the existing habitat components on designated big game winter range. Each stand was assigned the habitat component that *best* described the stand using the following criteria:

- Forage – forest stands with available forage in structural stages (SS) 1, 2, or 7, meadows, wetlands, riparian shrubfields.
- Thermal cover – stands in SS 3, 4, 5, and 6 with at least 60 percent canopy cover.
- Snow intercept thermal cover - stands in SS 6 with at least 70 percent canopy cover.
- Hiding cover – typically stands in SS 3, 4, 5.

Note that on the Newport-Sullivan Lake Ranger Districts, stands typed as thermal or snow intercept thermal cover are also providing hiding cover as a rule. This may also be the case for some stands typed as forage.

Table 8. Existing Acres of Habitat Components on Big Game Winter Range (Management Areas 6 and 8) in The Misery Lake Analysis Area.

Component	Existing	Forest Plan Goal
	A	A
Forage	1,198 (24%)	2,490 (50%)
Thermal Cover	187 (4%)	996 (20%)
Snow intercept cover	0	
Hiding cover	3,566 (72%)	1,494 (30%)
Other (e.g., rock)	28 (<1%)	NA
Total Winter Range	4,979 (100%)	4,979 (100%)

As displayed in Table 8, designated winter range in the project area is low in forage (24 percent) and exceeds cover goals (76 percent). Only about 187 acres (4 percent) of the designated winter range is providing thermal cover. An additional 157 acres of thermal cover exist in a designated MA-1 area (old growth associated species habitat). This MA-1 area is surrounded by designated winter range and is also providing wintering habitat for ungulates.

Recent research conducted in the Blue Mountains of Oregon and Washington has shown that there is "little justification for retaining thermal cover as a primary component of habitat evaluation models for elk" (Cook, et al., 2004). These authors stated that elk likely derive potential benefits from forest cover such as "enhanced security, reduced snow depth, and perhaps under some conditions, a better foraging environment." However, the thermo-regulatory properties of dense tree canopies have much less importance to elk than was originally thought. The provision of quality forage, hiding cover, and seclusion from human disturbances are now thought to be much more important management objectives. Deer are able to use cover down to about three acres in size. Dense pockets in some stands typed as hiding cover in the table above might also provide thermal cover for deer. Such inclusions are difficult to accurately map.

Effects to Big Game Cover and Forage

Alternative A – This alternative would likely have no immediate effect on big-game habitats since no forest management would occur. Over time, certain younger stands of trees would mature and begin to attain the necessary height and crown closure of thermal cover. Other stands that are too over-stocked with trees are likely to stagnate and never develop enough overhead canopy to provide thermal regulatory properties for big-game. Forage plants in plantations and more open forest stands would slowly decline in productivity as growing conifers begin to out-compete with them for sunlight, water, and soil nutrients. Designated winter ranges in the project area would accumulate more cover, while forage values would decline. This trend could be reversed by a large-scale wildfire. Ground and ladder fuels would continue to increase incrementally in forest stands across the project area. The potential for a large, intense wildfire to remove whole stands of conifers would increase over the long run. In the case of such an event, the resultant increase in sunlight on the forest floor would promote the growth of upland shrubs, grasses, and forbs; thereby providing new forage for big-game. However, high-intensity fires have the potential to burn large expanses of forest and result in very large openings. Forest edge associated species such as big-game may under-utilize the interiors of such large openings owing to the absence of nearby cover.

Stand-replacement wildfires are the most likely to provide good growing conditions for noxious weeds. With high intensity fires there would be more overhead canopy removed (higher light levels), more duff consumed (exposing soils), and less living vegetation for newly established weeds to compete with for sunlight, water, and soil nutrients. In areas of heavy weed infestation, existing native plants could be replaced, including those palatable to big-game animals. Large infestations could change the way the animals use the landscape by effectively reducing the area of suitable forage habitat.

Alternative B – Timber harvest, mechanical fuels treatments, and low-intensity, prescribed fires proposed with this alternative would reduce ground fuels and continuous fuel ladders. Future wildfires that occur in treated

stands should burn cooler and would be less likely to ascend into the crowns of over-story trees. Thus, the risk of a hot crown fire removing forest cover over large areas would be reduced in the project area.

Where low-intensity, prescribed fire is employed, decadent vegetation on upland shrubs and grasses would be removed. A "pulse" of nutrients would be released into the soil. Forage plants for big-game should respond to these burns with robust basal sprouting and an increase in palatability for several years following treatment.

Noxious weeds, which compete with native forage species, could potentially colonize soils exposed by logging equipment and prescribed fire. The design criteria listed in Chapter 2, the noxious weeds discussion in Chapter 3 and the noxious weed analysis report in the project file for this EA address methods to be used to reduce potential for noxious weed establishment and spread.

Commercial timber harvest would remove or degrade forest cover where it exists. Regeneration harvest (shelterwood) would convert hiding cover to open forage habitat for 15 or more years. Existing browse and green forage plants in these units should become markedly more palatable and productive; particularly where post-harvest underburning occurs. Regeneration harvest would create additional forest edge habitat. Alternative B would move the cover/forage ratio on deer winter range closer to the desired 50/50. If necessary, hiding cover blocks of three or more acres would be retained within the larger created openings to ensure that the distance to cover does not exceed 600 feet.

Where intermediate harvest prescriptions (commercial thinning, selection) are used, hiding cover would be locally degraded for five years or more, and essentially removed for at least that long within new skid trails. Based on intermediate harvests completed elsewhere on the Newport-Sullivan Lake Ranger Districts, there should be enough understory vegetation retained to provide hiding cover at the stand level.

Thinning and selection harvests would target suppressed, intermediate, and co-dominant trees and retain the most vigorous and full crowned trees (including all large trees). There would be less inter-tree competition for light, water, and soil nutrients in the residual stand. Over time, these treatments should promote the rapid development of larger, full crowned trees sooner than had no treatment occurred. High quality thermal cover could be developed in these stands over the long run.

Stands typed as thermal cover would not be harvested. Where pockets/inclusions of thermal cover at least three acres in size exist within stands proposed for harvest, they would be excluded from harvest.

The table below displays the changes in winter range habitat composition that would result from timber harvest in the project area.

Table 9. Acres of Habitat Components on Designated Deer Winter Range (MAs 6 and 8) by Alternative.

Winter Range Habitat component	Al A	A A
Forage	1,198 (24%)	1,841 (37%)
Thermal cover	187 (4%)	187 (4%)
Snow inter. cover	0	0
Hiding cover	3566 (72%)	2923 (59%)
Other	28 (<1%)	28 (<1%)
Total winter range	4,979 (100%)	4,979 (100%)

Cumulative Effects

Since 1988, forest management projects on the Newport-Sullivan Lake Ranger Districts have adhered to Forest Plan standards and guidelines for ungulate winter ranges. The Misery Lake project would contribute to the long-term objective of providing optimum levels/distribution of forage and cover habitat on NFS lands. The project would compliment big-game habitat improvements the Forest Service has completed and proposes to complete such as prescribed burning of upland shrub fields, noxious weed eradication in meadows, aspen protection and

restoration, and road closures. Big-game predators such as wolves could indirectly benefit from these projects. Converting approximately 600 acres from hiding cover to forage would move the area toward the objectives listed in the Forest Plan, although over a larger landscape would be a minimal change to winter range habitat.

Winter ranges on most private lands are not likely to be managed with the needs of wintering big-game in mind. The provision of a mosaic of cover and forage blocks are unlikely to be a consideration. Winter range areas on private lands would continue to be converted to agriculture and residential uses. Noxious weeds are likely to increase on private lands over time, due to an apparent low level of commitment to prevention, treatment, and monitoring.

Table 10 briefly summarizes the effects of the proposed Misery Lake Timber and Fuels Management Project to the other management indicator species listed previously. Full analysis for each species is located in the Analysis of Effects to Management Indicator Species and Landbirds specialist report, located in the project analysis file.

Table 10. Summary of Effects to MIS and Land birds

Species	Alternative	Effects
beaver	A	All existing habitats for beavers would be maintained in the analysis area with this alternative, at least in the short term. Over time, more hardwoods would be lost to senescence and forest succession, reducing forage resources for beavers in the area. This process could be reversed in areas that experience future, large wildfires.
	B	No harvest or burning activities would occur within riparian vegetation. Logging would occur in upland areas directly adjacent to RHCAs. The increase in light levels in harvested units should improve growing conditions for hardwoods in the units. With this alternative, areas treated with low-severity, prescribed fire would be a mosaic of burned and un-burned sites. Because aspen and birch trees are thin-barked and fire sensitive, they are likely to experience immediate or delayed mortality on burned sites. However, their underground root systems are likely to survive these low-intensity fires. Following the burns the roots should send up a profusion of new sprouts, potentially rejuvenating and perpetuating the stands. In some locations, cattle and wild ungulates might over-browse these new shoots to the point where they never become mature trees. These effects should be swamped by the sheer numbers of new stems produced across the landscape. Future forest management on all ownerships in the watersheds is likely to benefit hardwoods (and thus beavers) by removing conifer cover.
pine marten, barred owl, and pileated woodpecker	A	Old forest structures recruited according to natural processes. Dense, stagnated stands of small diameter trees are unlikely to ever produce significant numbers of larger trees. In many stands, dense understories of shade tolerant trees would continue to grow into the canopies of over-story trees. Aging lodgepole pine (LP) trees would become more susceptible to mountain pine beetle attack across the project area. Large die-offs of LP would lead to heavy concentrations of fuels as they fall to the ground. These processes would tend to increase the risk of stand-replacing fires that could remove potential reproductive habitat for these three MIS. Such fires could sever travel corridors for marten across the landscape.
	B	No commercial timber harvest would occur within any old growth stands (none exist) or within late and old structural stage stands. The only large trees (21"+ dbh) that would be harvested anywhere in the project area would be those present within new road or equipment corridors, landings and rock pits. To the extent feasible, the Forest Service would re-use existing equipment corridors and avoid large trees when marking new corridors[27] . Intermediate harvests (commercial thin, selection) would reduce tree stocking levels over hundreds of acres of stands in middle structural stages. Suppressed, intermediate and co-dominant trees would be targeted for harvest ("thin from below"). The most full-crowned and vigorous appearing trees would be retained, including all large trees. These remaining trees would experience reduced competition for sunlight, water, and soil nutrients. They should put on more crown and diameter growth sooner than had no harvest occurred. Fuel ladders in harvested stands would be reduced, lowering the risk of a ground fire climbing into the over-story tree canopies. Horizontal cover at ground level should be largely maintained, except within equipment corridors and log landings. The reduction in tree crown biomass could make a pine marten or pileated woodpecker more vulnerable to avian predators (ex. goshawks) in harvested areas. Large bodied birds such as barred owls would have greater access and maneuverability in thinned stands. In 15-20 years, tree crowns should grow to the point that the overhead canopy resembles pre-harvest levels. No commercial timber harvest, precommercial thinning, or mechanical fuels treatments would occur in *designated habitat areas.* Prescribed fire would be used in portions of these areas to reduce surface and ladder fuels. These fires would affect mostly under-story vegetation. They might degrade or remove horizontal cover in small areas over the short term. There should be little to no appreciable effects to horizontal cover at the stand level. There might be local, long-term benefits to over-story tree vigor resulting from these burns. Decreased risk of habitat loss to stand-replacement wildfire. State Forest Practice regulations do not prohibit the harvest of large diameter trees on state or private lands. Many large trees have been removed from these ownerships in the watersheds. This trend is likely to continue.

[27] Personal communication with Jim Powell, Colville National Forest Sale Administrator.

Species	Alternative	Effects
primary cavity excavators	A	Dead tree habitat would be recruited or lost according to natural processes. The few large over-story trees that survived the fires of the late 1930s would continue to provide some high quality snag habitat as they die. Stands that originated after fires are 65–85 years old and have not had time to grow many large trees. Many stands are overstocked. Few trees would ever attain large size within dense, stagnated stands/pockets of trees. Increasing risk of stand-replacing fires, and beetle populations increasing above endemic levels, could create a large "pulse" of snag habitat. Within 1-2 decades of being created, most standing snags would have fallen, leaving a decades-long gap in the availability of new snag habitat in intensely burned areas, while the area becomes re-forested. Some snags would still be available in unburned areas across the landscape.
	B	There are currently an estimated five to six snags (greater than 10" dbh) per acre. No snags or 20+ inch diameter logs of down material would be marked for harvest. Within Lodgepole stands no logs 14"+ dbh would be harvested. Timber harvest and noncommercial treatments proposed would reduce tree stocking in over-crowded stands. Residual trees should be better able to fend off insect and disease attack. This could reduce the recruitment rate of snags in the project area over the short to mid term. The area is expected to have a minor reduction in existing snag levels. Surface and ladder fuels would be reduced across thousands of acres of forest stands in the project area. The risk of an intense, stand-replacing fire would be reduced. This alternative would promote the growth of large trees and result in a greater likelihood of retaining large tree habitat on the landscape over time, thus promoting a steady recruitment rate of high quality snags and down logs, over the long run. Existing snags and defective live trees must be reserved on state and private lands according to Washington State Forest Practices standards. As a rule, fewer trees and logs would be retained on these ownerships than on the Colville National Forest. On state and private lands there would continue to be a cumulative reduction in foraging and nesting sites for woodpeckers, and for secondary cavity nesters such as bluebirds and kestrels.
northern three-toed woodpecker	A	Specific habitats used include trees with bark beetles, disease, and heart rot, and recently burned forests with abundant wood boring insects. Habitat would be recruited according to natural processes. Lodgepole, subalpine fir, grand fir, and spruce would continue to grow and mature over time. As these trees become more susceptible to insect and disease attack, they would begin to provide foraging sites for three-toed woodpeckers. With the continuing buildup of ground and ladder fuels in the area, the potential for these thin-barked trees to be killed in a large, intense fire would increase. Such an event would provide a "pulse" of suitable habitat for three-toed woodpeckers for several years. Lodgepole seedlings would likely colonize areas of high-intensity burns where mineral soil is exposed and sunlight is plentiful.
	B	Lodgepole would be favored for removal in harvest areas, but no stands with a dominant spruce component would be harvested. No existing snags marked for harvest. Lodgepole trees of all sizes would be greatly reduced in number, eliminating some existing potential habitat for three-toed woodpeckers. Long-term impacts to habitat levels would be more severe, since a large percentage of the mature lodgepole trees that would have eventually succumbed to insect or disease attack would be harvested. These effects would be offset by the following factors: (1) un-harvested lodgepole-dominated stands would still exist within RHCAs, core habitat areas for old-growth associated species, and other areas not proposed for harvest; (2) an average of 20-25 trees per acre would be reserved from harvest within shelterwood units, many more within commercial thins or other harvest prescriptions; (3) site prep operations (underburning, pile burning, etc.) would create some snags; (4) reserve trees would occasionally be injured by logging equipment, providing pathways for pathogens into the tree boles; and (5) in harvested units where snag habitat does not meet prescribed levels, the FS would create snags through inoculation with forest pathogens or other means.
blue grouse	A	Due to fire suppression policies and the resultant build-up of fuels, the potential for a large, hot fire would continue to increase in the area. In such an event, brood habitat might be created where some over-story trees survive. Concealing cover adjacent to springs and other water sources could be removed where wildfires burn hot. Potential loss of open park-like forest habitats over time to young conifer encroachment.
	B	Thinning and fuels treatments proposed would promote timber stands with more open under-stories. Grasses, forbs and shrubs utilized by blue grouse should benefit from the increased light levels in harvested units. In areas proposed for under-burning, the above-ground portions of these plants might be consumed. However, most should re-sprout from their root systems and are likely to benefit from the

Species	Alternative	Effects
		"pulse" of nutrients released into the soil from vegetation and woody debris consumed by the fires. The suitability of the project area as brood habitat for blue grouse might be locally enhanced. Roost tree habitat and hiding cover near water sources would be protected per INFISH guidelines.
large raptors/great blue heron	A	All existing habitats for large raptors and herons would be maintained over the short term. As dense patches of young conifers continue to grow into stand over-stories, the ability of large-bodied raptors such as great horned owls to effectively utilize these stands would diminish. This increase in forest "thickets" could benefit small raptors such as sharp-shinned hawks that select such stands for nesting. With the increase in tree biomass and fuel ladders, the potential for a high intensity, stand-replacing fire would increase in the area. Such a fire could remove suitable nest trees/stands, for large raptors and herons. Large burned areas would lack concealing cover for ambush hunters such as goshawks.
	B	In harvested stands the overhead canopy would be opened up. Mid-canopy layers would be simplified. Concealing cover for large raptors would be diminished, and removed where openings are created. This could reduce the ability of certain species to effectively hunt, and make them more susceptible to mobbing and predation. However, harvest prescriptions that create openings would be mostly utilized within stands of smaller diameter trees that have a high lodgepole pine component. These stands tend to provide inferior nesting and foraging habitats for large-bodied raptors. In thinned stands, large raptors would have less "clutter" to negotiate when flying through the tree canopy. Some of the stands proposed for thinning are so dense they may presently be avoided by these birds. Raptors which hunt rodents in forest openings or along forest edges should find improved foraging conditions for several years following timber harvest. Timber harvest would not occur within designated core habitat areas for old growth associated species, or other stands having late and old structure. Timber harvest would not occur within the mapped goshawk nest stands or post-fledging area (PFA). Together, these areas include the stands having the highest canopy closure in the project area. Under-burning could occur in the goshawk post-fledging area (PFA). The Forest Service conducts prescribed burning operations during optimum weather and fuel moisture conditions, in order to ensure low-intensity fire behavior. During project implementation, the Forest Service would monitor the known goshawk territory. If nesting activity is documented or suspected, no project activities would be allowed within the PFA from March 1 to August 15, in order to avoid disturbing the nesting pair and young.
land birds	A	Concerns regarding the encroachment of dense fir regeneration into once park-like, dry forest stands would not be addressed. Over long periods of time, additional late and old structural stage stands could be recruited in the project area. Dense, stagnated stands of small diameter trees are unlikely to ever produce significant numbers of larger trees. Fuel loads in the area would continue to increase incrementally over time. The potential for a large, hot wildfire to remove entire swaths of priority forest habitats would increase. Riparian woodlands on private lands would continue to be converted to residential and commercial uses.
	B	Where timber harvest reduces the overhead tree canopy, nesting habitat for those landbird species that prefer closed canopies would be adversely affected. The more open, park-like conditions preferred by white-headed woodpeckers and chipping sparrows would be promoted in thinned stands. Prescribed burns could remove nesting habitats of ground nesters such as Townsend's solitaire and dark-eyed juncos, and shrub/low canopy nesters such as spotted towhees and MacGillivray's warbler. However, these habitat losses would be local in nature and short-lived. Most upland shrubs and grasses should quickly re-sprout, and regain much of their above ground biomass in one or two growing seasons. The shrub layer is likely to become more robust due to increased light levels in thinned forest stands. Many bird species that lose nests to fire or timber harvest are capable of re-nesting in the same season. The potential loss of individual birds or nests during spring project operations would be offset by the long-term benefits of reducing the risk of high-intensity wildfires. Alternative B would also promote the development of late and old structural stage conditions in both dry and mesic mixed conifer forest stands. Thus, this alternative should provide long-term benefits to land bird populations.

MIS Summary
The alternatives as proposed are consistent with Forest Plan standards and guidelines for MIS. Alternative B would move the project area closer to its historic condition with regards to tree species mix, stocking levels, and fuel loading. Alternative B would reduce the risk of stand-replacement fires in the project area. Thus, this alternative would better meet the management goals for priority habitats for land birds in the Northern Rocky Mountains.

Threatened, Endangered, and Sensitive Species (TES)
The Misery Lake project area contains habitat for several federally threatened or endangered species that were considered in the analysis. The following table briefly describes the effects of the proposed Misery Lake Timber and Fuels Management Project on threatened, endangered, and sensitive species, including the rationale for each determination. Full analysis for each species is located in the Biological Evaluation (located in appendix D).

Table 11. Summary of Effects to Threatened, Endangered, and Sensitive Species.

Species	Alternative	Determination	Rationale for Determination
gray wolf (FS sensitive)	A	not likely to cause a trend to federal listing	Project is outside recovery habitat. Increasing fuel loads would continue to elevate the risk of forest cover loss to future, hot fires. Such fires could promote big-game forage.
	B		Temporary reduction in seclusion from project activities. There would be a temporary increase in total road density, but road closure work (part of project design) would produce final result of decreased road density. Roadside hiding cover maintained where feasible. Reduced risk of fires removing cover for big-game. Potential for local improvements in green forage/upland shrub growth from timber harvest and under-burning which improves big-game (prey species) habitat.
grizzly bear (threatened)	A	may affect, not likely to adversely affect	Project is outside recovery habitat. Increasing fuel loads would continue to elevate the risk of forest cover loss to future, hot fires. Such fires could promote forage.
	B		Temporary reduction in seclusion from project activities. Increase in total road density but road closure work part of project design. Roadside hiding cover maintained where feasible. Potential for local improvements in forage from burning and timber harvest.
Canada lynx (threatened)	A and B	no effect	Project lies outside primary lynx range. Activities would not occur within the vicinity of any known lynx den site. Project is consistent with Lynx Conservation Assessment and Strategy.
Bull trout (threatened)	A	may affect, not likely to adversely affect	No effects to existing or potential habitat
	B		No bull trout are presently known to occupy habitat within the Ruby Creek watershed. Actions would maintain the current condition and would not hinder or prevent attainment of relevant "functioning appropriately" indicators

Species	Alternative	Determination	Rationale for Determination
bald eagle (FS sensitive)	A	not likely to cause a trend to federal listing	No immediate impacts to any existing habitats. Increasing fuel loads would continue to elevate the risk of large tree loss to future, high intensity crown fires.
	B		No large trees marked for harvest. Large tree habitat (used for nest and perch sites) promoted through thinning. Known nest and foraging areas avoided.
wolverine (FS sensitive)	A and B	not likely to cause a trend to federal listing	Same as for gray wolves.
Townsend's big-eared bat (FS sensitive)	A and B	no impact	All known occupied and potential habitats avoided.
Fisher (FS sensitive)	A	not likely to cause a trend to federal listing	No known records from the area. Minor amounts of potential habitat. No immediate impacts to potential habitats but increasing fuel loads would continue to elevate the risk of habitat loss to future, hot wildfires.
	B		Fishers are closely associated with forested riparian areas which are used extensively for foraging, resting, and as travel corridors. Reduction in canopy closure and horizontal cover for possibly 15 years in small pockets, but overall impacts at the stand level should be small. Decreased risk of large forest structures (live and dead trees and down logs) being consumed by wildfire. Large tree habitat promoted through thinning. Alt. B would create short-term negative effects to low quality reproductive and foraging habitats but also initiate long-term positive trends in habitat development.
great gray owl (FS sensitive)	A and B	not likely to cause a trend to federal listing	Same as for fishers.
northern leopard frog, sandhill crane, eared grebe (FS sensitive)	A	no impact	Species not found during field surveys. No known records from the area. Essential habitats (wetlands, ponds, etc.) avoided.
	B	not likely to cause a trend to federal listing	
westslope cutthroat trout (FS sensitive)	A and B	no effect	No new road crossings or medium or heavy reconstruction would occur on fish-bearing streams; no impact from timber harvest or burning is expected.
redband trout (FS sensitive)	A and B	no effect	No redband trout are known to inhabit the project area.
pygmy whitefish (FS sensitive)	A and B	no effect	No pygmy whitefish are known to inhabit the project area.

Sensitive Plants

Existing Condition

There are no federally threatened or endangered plant species documented or suspected from the project area. The pre-field review showed two sensitive plant species documented from the project area: *Botrychium crenulatum* and *Dryopteris cristata*. Five additional sensitive plant occurrences were found during these surveys:

one each of *Antennaria parvifolia, Botrychium pedunculosum* and *Viola renifolia*, and two of *Sisyrinchium septentrionale*.

Effects of Alternatives A and B
Under alternative A, current management plans would continue and natural processes would continue to dominate. Changes in stand condition and/or progression toward old-growth conditions would be slow. The risk of losing much of this area to stand-replacing wildfire would increase over time. Without fire some younger stands would mature and develop more canopy closure. Over-stocked stands are likely to stagnate and have the potential for increased insect and disease activity. Changes in stocking and canopy closure may impact individual sensitive plants, but are not likely to result in a trend to federal listing or loss of viability of any sensitive plant species.

Under alternative B, activities are proposed that have potential to affect known populations of five sensitive plant species: *Antennaria parvifolia, Botrychium crenulatum, B. pedunculosum, Sisyrinchium septentrionale,* and *Viola renifolia*. Negative impacts to these species and their habitat are possible, but would be minimized with the implementation of recommended project design criteria. Based on risk assessments, mitigation is required for two sensitive plant species.

The one location of *Botrychium crenulatum* within the project area is adjacent to a proposed underburn unit. Prescribed fires in forested habitats are expected to mimic natural disturbances. These fires do not pose a threat to *Botrychium* species, unless they burn exceptionally hot or occur when the soil is desiccated (Johnson-Groh and Farrar 1996).

Although the forested wetland habitat of *Viola renifolia* is not proposed for any management activities, the one known site of it in the project area is between units 64 and 68. These are units proposed for commercial thinning with a shelterwood harvest with a mechanical fuel treatment under alternative B. The proposed actions have potential to directly impact the sensitive plants by altering habitat conditions on the forest floor and decreasing overhead shading. If the specific design criteria are followed, there should be no negative impacts to the population.

No other sensitive plants were found in the timber harvest units that were surveyed. Since alternative B would result in a net improvement to future single storied old-growth habitat conditions through restoration activities, no long-term adverse affects of the proposed timber harvest on sensitive plant species are expected. Underburning in the forested habitats is expected to mimic natural disturbances. The prescribed burns may burn individuals in burning units, but no negative long-term effects to sensitive plant species are expected. There are no known sensitive plant locations in any of the areas proposed for road construction, reconstruction, or pit developments.

Antennaria parvifolia, Botrychium pedunculosum and *Sisyrinchium septentrionale* occur in a meadow in the project area. No studies have been conducted on these species to measure the effect of fire on them or their response to fire. Since meadows where they occur have a low intensity and high frequency fire regime, they are likely adapted to fire. The proposed prescribed burning for this project would mimic these conditions and should not adversely affect potential habitat of these species.

Under Alternative B one location of *Sisyrinchium septentrionale* is adjacent to a proposed shelterwood harvest unit with an underburn. These proposed activities may directly impact known populations by altering meadow habitat conditions. This alternative may impact individuals, but is not likely to result in a trend to federal listing or loss of viability of this species.

Cumulative Effects
There should be no negative cumulative effects from commercial or noncommercial treatments, road construction, or reconstruction, if the design criteria are implemented. Since the sensitive plants in northeastern Washington forests have evolved with fire, there should be no negative long-term cumulative effects from prescribed fires. There are no regulations to protect sensitive plants on private land. Our determination that this

project is "not likely to cause a trend toward federal listing or loss of viability" is based upon known occurrences on federal lands alone.

Adherence to Forest Plan standards and guidelines would prevent adverse effects to sensitive plants under all alternatives. There are no irreversible or irretrievable effects associated with alternative B if the design criteria are implemented.

Fish Habitat

Existing Condition

Regional Existing Population Condition

Regionally, most native salmonid numbers and distribution are lower than historic levels. This decline is due to dam construction and operation, water diversions, introduction of non-native fish species and habitat degradation.

Rainbow trout range throughout the Pacific Northwest. A subspecies, interior redband trout ranges from the east side of the Cascades to the Selkirks. Pure interior redband trout have not been found in the Pend Oreille subbasin.

Westslope cutthroat trout, a subspecies of cutthroat trout, range from the upper Kootenay River drainage of British Columbia and Montana; the upper Columbia and Fraser Rivers of British Columbia; the Pend Oreille, Clark Fork, St Joe, and Spokane River drainages; the Salmon and Clearwater drainages; the Lake Chelan drainages and the John Day River drainage, in Oregon. On the east side of the Continental Divide, the westslope cutthroat is native to the South Saskatchewan River and the upper Missouri River drainage (Behnke 1992).

Bull trout are native to the Pacific Northwest and are found in North America from the Oregon-California border eastward to Nevada, north through western Montana and western Alberta, westward through British Columbia, and north to at least 60 degrees N latitude in Alaska (Wydoski and Whitney 2003). Natural climatic warming and loss of coldwater habitat since the Pleistocene period exacerbated by effects of human activities have reduced their distribution (Cavender 1978).

Watershed Existing Population Condition

No historic information is available for the fish population of specific drainages within the analysis area. There are no known natural blockages presently preventing fish passage between Box Canyon Reservoir and the tributaries in this analysis area. There is one undersized culvert on North Fork Ruby Creek and another two undersized culverts on Ruby Creek proper that prevent upstream fish passage at least seasonally.

The analysis area contains two perennial, fish bearing creeks. These are Ruby Creek and the South Fork Lost Creek. These watersheds have been surveyed for the presence of fish and for physical habitat condition using the Hankin-Reeves survey protocol in 1992; 1994 and 2004-5.

South Fork Lost Creek contains eastern brook trout (*Salvelinus fontinalis*) and coastal rainbow trout (*Oncorhynchus mykiss irideus*) (Powell 2002). As well, cutthroat trout, in the upper South Fork have been genetically analyzed and, based upon assays at the FWS Idaho Fish Health Center, contain only westslope cutthroat trout alleles with no evidence of introgression from rainbow trout. The South Fork Lost Creek forms the northern boundary of the analysis area.

Ruby Creek contains eastern brook trout, cutthroat trout, and brown trout (*Salmo trutta*). It is unclear whether the cutthroat trout, in this stream, are pure westslope trout as the number of fish sampled so far has been too small to statistically validate any genetic analysis.

Individual bull trout (*Salvelinus confluentus*) have been found in Box Canyon Reservoir, a 55 mile segment of the Pend Oreille River from Box Canyon Dam to Albeni Falls Dam. Bull trout in the reservoir have been most recently captured and documented between 1988 and 2004. The total number of fish captured was 20 individuals. Fourteen of these individuals were spawning age migratory adults. The streams in the analysis area flow into this reservoir. No known barriers to upstream fish passage exist in the South Fork Lost Creek. The first barriers to fish passage on Ruby Creek are located at the western edge of the analysis area.

Biotic surveys were done in Ruby Creek (1992, 1994, 2004, and 2005) and in the South Fork of Lost Creek (1994) to determine fish presence. No bull trout were found during these surveys in the Misery Lake analysis area. Bull trout are not known to inhabit the analysis area but instream and riparian habitat are protected by following INFISH standards and guidelines. Private lands in the analysis area on Ruby Creek are designated critical habitat for bull trout (USFWS 2004). Ruby Creek is considered core area habitat for bull trout within the Draft Bull Trout Recovery Plan (USFWS 1998).

River Basin Existing Habitat Condition

The Pend Oreille River between Box Canyon and Albeni Falls dams is a slow water reservoir. The water retention time is longer, water velocities slower, water temperatures slightly higher and channel width is wider than when the river was in its free flowing condition. The reservoir now supports much greater biomass of aquatic vegetation than in its riverine form. Eurasian water-milfoil, an aquatic noxious weed, comprises a significant portion of this aquatic vegetation. Former riffles, gravel bars, side channels and pools have been inundated by the present water levels behind the dam. Large woody debris is almost non-existent. The habitat is more suitable for spiny-ray fish than for salmonids due to lack of habitat complexity and summer water temperatures.

Watershed Existing Habitat Condition

Streams in this analysis area were surveyed between 1993 and 2005 and the R6 Hankin-Reeves Stream Survey protocol was used for these surveys.

Summary

The streams in the analysis area have been impacted in the past from homesteading, timber harvest, past fires, and cattle grazing. Reach 1 on North Fork Ruby Creek and reaches 3 and 5 on Ruby Creek are located in flat valley floors dominated by spirea. There are very few trees, in these floors, large enough to meet the INFISH standard for large wood if they were to fall in the stream. Reaches 1 and 3 on Ruby Creek are not meeting Bankfull Width/Depth (BFWD) ratios. Cattle trampling in meadows could be one of the main causes of higher BFWD ratios. With the cattle and the wildlife eating the new shoots of alder, cedar, and other riparian trees, the trampling is causing erosion of the streambanks. The sediment entering the creek causes the pools to fill, and the stream channel widens. Beaver ponds in these two reaches could also be contributing to larger BFWDs. Temperature standards are not being met on South Fork Lost Creek and Ruby Creek. Lack of shading could be contributing to higher stream temperatures.

Although limited, existing data indicates that present water temperatures in streams do not meet the Inland Native Fish Strategy (INFISH) riparian management objective (RMO) for water temperatures for spawning and rearing habitat for bull trout. These temperatures also exceed state water quality standards for these particular streams.

Effects of Alternative A

Water temperature

The water temperature regimes are expected to remain stable. This alternative would not increase the amount of open area in upland or riparian vegetation or increase the existing drainage pattern in any watershed in the project area. The existing level of soil movement from streambank erosion and other sources into the stream systems within the project area is expected to continue. Existing stream and riparian habitat conditions are expected to remain stable or improve slightly as stocking levels and tree heights increase on federal lands due to a lack of timber harvest and road construction within RHCAS on NFS lands and limited riparian harvest on state and private lands.

Cattle grazing would continue at existing levels and seasons of use within the analysis area. Water quality is expected to remain at existing levels on streams within the analysis area used for grazing over the next 10-15 years. No changes to the state 303(d) list are anticipated for these streams during this time. Transitory range would continue to disappear as older regeneration harvest units become mature and shade out much of the understory vegetation. This would increase grazing pressure along roads, meadows and the accessible portions of streams and wetlands.

The flow regime and the existing level of shading along streams in the project area would remain stable or slightly increase as regeneration harvest units and existing riparian vegetation matures. For these reasons, the alternative is not expected to prevent or retard movement toward achievement of this RMO on any of the creeks within the project area. This alternative is not anticipated to contribute to raising water temperatures of Box Canyon Reservoir during the summer months since the function of the riparian vegetation, including shading, would remain stable. As well, existing vegetation in both riparian and upland areas on NFS lands would continue to mature and decrease the percentage of the subwatersheds in open condition. These changes in vegetative cover should lead towards a more natural flow regime with close to natural summer flows and summer water temperatures.

Since the function of a majority of the riparian vegetation to provide shade is not expected to change, summer water temperatures should not noticeably change on stream systems on the forest.

Pool frequency

The existing levels of soil movement into the streams from natural and other sources, such as roads (including OHV use) and overgrazing of riparian vegetation would continue. Sediment entering the stream can fill pools, reducing their quality or eliminating the pool habitat altogether. Instream wood is an important factor in the formation of pool habitat. The function of the existing riparian vegetation to provide future large instream wood is expected to improve as riparian vegetation matures and decays.

Pool habitat is particularly important for winter rearing by trout species in perennial fish-bearing streams within the project area. Existing stream and riparian habitat conditions, including pool frequency, are anticipated to remain stable or slightly improve within the project area.

Under this alternative the level of sediment accumulation of the South Fork of Lost Creek, Ruby Creek and other unnamed tributaries is expected to continue, through natural levels of erosion, the use of the existing road systems by OHV, the Air Force Survival School and other users, dispersed recreational use of riparian areas and use of the riparian areas by livestock on NFS lands within the analysis area. The effect of the present contribution of sediment to the watersheds in the analysis area would be to maintain the present quality and quantity of pool habitat.

Since logging on private lands must comply with state forest and fish rules, there is some level of protection of perennial streams to reduce the level of sediment entering the streams. Due to these rules and the lack of additional harvest and road construction activity on NFS lands within the riparian habitat, pool quantity should not noticeably change on stream systems in the analysis area.

Large woody debris

Existing riparian vegetation within the project area would not be affected. Riparian vegetation would continue to mature and continue to provide recruitment for future instream wood. Large woody debris numbers would remain stable as old instream wood is replaced by a continual source. The existing levels of instream wood, in surveyed streams within the project area, are expected to continue to meet this INFISH RMO.

Large instream wood recruitment is not anticipated to noticeably change over existing levels. No new harvest units would be implemented on NFS lands. Logging would continue on private lands in and adjacent to the analysis area. Since logging on private lands must comply with state forest and fish rules, there is some level of protection of riparian habitat along fish bearing, perennial streams to ensure a source for future large wood entering the streams. However, riparian vegetation would continue to be harvested along non-fish bearing and intermittent streams and all stream crossings on private and state lands in the analysis area. This activity would continue to reduce available large instream wood recruitment in the future on private lands. No additional harvest and road construction activity in riparian vegetation would occur on NFS lands and numbers of large instream wood are expected to remain stable on stream systems on NFS lands within the analysis area.

Bankfull Width/Depth (BWD) Ratio

There are many factors affecting the bankfull width/depth ratio for streams within the analysis area including utilization of its riparian vegetation and compaction of its banks from livestock grazing and dispersed recreation.

Sediment that is eroded due to these activities can be deposited in the lower gradient stream channel reaches. The contribution of sediment from the tributaries within the project area, however, is likely to be minor when compared to the background level of erosion and other contributors, particularly roads throughout the analysis area.

Existing information on the wetted width/depth ratio, which is an INFISH RMO, is not available. Bankfull width/depth ratios are better indicators of channel condition. The existing bankfull width/depth ratios on a majority of the reaches of surveyed streams within the project area are within the expected BWD ratios. The exception is the North Fork of Ruby Creek is heavily influenced by past and present beaver ponds and dams. BWD ratios for the North Fork of Ruby Creek are slightly lower than the expected range. The few reaches found in the headwaters of the analysis area are also within the range for those channel types. This alternative is expected to continue to meet the BWD ratio on most reaches.

Channel morphology is anticipated to remain stable at existing levels. No new harvest units would be implemented on NFS lands. Logging would continue on private lands within and adjacent to the analysis area. Since logging on private lands must comply with state forest and fish rules, there is some level of protection of riparian habitat along fish bearing, perennial streams to protect streambank integrity and reduce sediment input. Lesser protection exists for non-fish bearing perennial streams and no protection for intermittent streams on private lands. New road crossings and logging along on these other categories of streams on private lands would continue to maintain the existing bankfull width/depth ratios in the immediate reach and downstream reaches. The existing level of sediment input from existing road use and grazing on NFS lands would also continue to accumulate in the lower gradient sections of stream habitat in the analysis area.

Embeddedness

Sediment entering a stream can fill interstitial spaces within spawning gravels and other size substrate that is used for hiding cover for fry and juveniles and habitat for macroinvertebrates. Increased levels of sediment can reduce the quality of aquatic habitat or eliminate the habitat altogether.

High embeddedness levels exist in a majority of the reaches surveyed in Ruby Creek within the project area. The existing level of soil movement from riparian areas overutilized by livestock, roads and from other sources into the streams, within the analysis area, is expected to remain at existing levels. Existing stream and riparian habitat conditions are expected to remain stable within the analysis area. Certain road segments adjacent to streams and easy livestock access to riparian areas within the project area are expected to continue to have an effect on aquatic habitat.

This alternative is anticipated to continue the level of embeddedness of Ruby Creek. The effect of the contribution from the analysis area, however, is likely to be minor when compared to the background level of erosion and other contributors, particularly roads throughout the larger Ruby Creek watershed.

Use of the existing road systems, continued grazing in the riparian areas and recreational use of NFS lands in the analysis area would continue to be a source of sediment in addition to the present level of embeddedness of stream habitat on lower gradient sections of stream in the analysis area. The effects of sediment contribution from these activities on NFS lands, through the filling of streambed substrate and pools in low gradient segments of the streams, is expected to continue within the analysis area.

Riparian Vegetation

The present function of the riparian vegetation would remain stable. A majority of surveyed streams within the project area meet the INFISH RMOs for instream wood and width/depth ratio indicating that the riparian vegetation is functioning well. Riparian vegetation is expected to continue to develop and mature where it was removed during timber harvest in the 1970s and 1980s. This alternative is expected to maintain the stable condition of the riparian vegetation throughout the project area.

This alternative is not anticipated to have an effect on the riparian vegetation of the analysis area since no new activity is proposed here.

Fish Populations

Fish population of the South Fork of Lost and Ruby creeks would continue to be affected by the contribution of sediment-laden waters from subwatersheds which maintains the present levels of embeddedness of the spawning and rearing habitat in these creeks.

Sediment transported downstream from road use by OHVs and other vehicles and cattle grazing on NFS lands would add to the overall level of sediment levels found primarily in lower gradient sections of fish habitat. This additional sediment input continues, in part, to maintain high levels of embeddedness of streambed substrate. These levels of embeddedness can decrease reproductive success of salmonids species in the affected habitat through the filling of interstitial spaces between gravels and cobbles of spawning areas. This filling reduces the flow of oxygen to and transport of metabolic wastes away from the eggs.

Effects of Alternative B

Water temperature

Limited timber harvest, new road construction, system road reconstruction, and road decommissioning are proposed within the RHCAs of streams within the analysis area. Timber Best Management Practices (BMP) PT-7 Riparian Habitat Conservation Area Designation and Protection would be implemented. Timber harvest is proposed in a five units within the RHCA of Ruby Creek within the analysis area. No harvest would occur within the RHCA along any perennial fishbearing stream unless the area is separated from the stream by a system road or a topographic break within the riparian area. The objective of harvest in these portions of the RHCA is to maintain the function of the riparian vegetation to meet INFISH RMOs.

This alternative is not expected to prevent or retard movement toward achievement of the water temperature RMO on any of the creeks within the project area due to proposed timber harvest. Proposed timber harvest would not diminish the overhead tree canopy that influences stream temperature along perennial streams. The effects of the new road construction in these subwatersheds, within the analysis area, is not expected to imbalance the existing flow regimes, lower summer flows and increase summer water temperatures due to their limited nature. The effects of the addition of new road construction to the existing drainage network, in watersheds within the analysis area, is countered by the decommissioning of approximately 8 miles and closure of the 4.8 miles of newly constructed system road.

The function of the riparian vegetation to provide direct overhead shading would remain stable except where culverts are removed and streambanks are revegetated. This should add a minor amount of shading over time in those drainages affected.

Stream channels and flows in the analysis area have adjusted to past management related created openings (i.e. homestead meadows and road corridors). The proposed treatments, under this alternative, are not anticipated to increase flows beyond those historically encountered in these watersheds in the past.

For this reason, this alternative is not anticipated to contribute to raising water temperatures of Ruby or the South Fork of Lost Creek or unnamed tributaries to the reservoir during the summer months.

No downstream cumulative effects to stream temperatures are anticipated to occur under this alternative since INFISH RHCAs would remain intact and undisturbed except for limited riparian vegetation disturbance during construction of 3 stream crossings and upland vegetation removal in 5 units. Downstream cumulative effects of these combined with other ongoing activities to temperature would likely be minimal using standard monitoring techniques.

Pool Frequency

The function of the riparian vegetation to provide instream wood recruitment, which is a major factor in the creation of pools, would remain stable. Any sediment increase would be limited to new crossings in intermittent and perennial, non-fishbearing streams under alternative B. Due to these reasons, the effects of the proposed harvest and new road construction and light reconstruction in these subwatersheds, within the analysis area, is not expected to impact the number and quality of pools.

Under this alternative, road construction and the removal of culverts during decommissioning of roads within the riparian area may cause an increase in sediment introduction into certain segments of other streams within the analysis area. Other than in Ruby Creek, no fishbearing habitat would be affected by this action as these activities would occur in non-fishbearing drainages. The temporary, negative impact on fish and fish habitat in Ruby Creek would be offset by the long-term benefit to fish from the new permanent access to approximately 5 miles of suitable habitat above the two culverts. This increase, in addition to any contribution of sediment from logging on private and state lands, may increase the level of filling of pools on low gradient sections of streams located downstream of the activities within riparian areas. Alternative B is likely to have a slight cumulative effect to pool habitat on the lower gradient reaches of creeks within the analysis area for this reason.

Large Woody Debris

Proposed timber harvest, within a small portion of the riparian areas of a few units, is expected to improve the function of the riparian vegetation. However, since these areas are on gentle to almost level terraces on the outside edge of the RHCAs, large instream wood recruitment is not expected in the future. These activities are not anticipated to diminish the overall function of the remaining riparian vegetation to provide a recruitment source for large instream wood for this stream in the analysis area. It is anticipated, therefore, that there would still be adequate instream wood to stabilize channel structure and provide fish habitat under this alternative.

Due to these reasons, the effects of the proposed harvest and new road construction and reconstruction in these subwatersheds, within the analysis area, is not expected to impact the ability of the riparian vegetation to contribute large instream woody debris in the future.

Road construction, within the riparian area on NFS lands, may cause a slight decrease in potential numbers of available large instream wood recruitment into certain segments of streams on NFS lands. All of the proposed new road crossings are located in the riparian areas of intermittent and non-fish bearing perennial streams. This decrease in wood contribution is considered in addition to the continuing decrease in potential large wood from logging on private lands. The availability of large instream wood for cover, foraging, sediment collection, and pool formation should continue to be adequate for fish populations on NFS lands and is not expected to affect its supply or availability on private lands within the analysis area.

BWD Ratio

Minor changes in channel morphology may occur under Alternative B as a result of three new stream crossings and removal of six existing culverts. Compliance with Washington Department of Fish and Wildlife Hydraulic Permit Approval requirements and road BMPs would reduce any potential sediment input as a result of the crossing construction and therefore reduce the potential of project-related increases in bankfull width/depth ratios.

Aggradation of the channel is not anticipated to occur below the three new road crossings or the removal of 6 culverts due to the initial increase in sediment levels. Any initial increase in on-site erosion is expected to pass through the stream system since these road crossings are not located within or immediately above a low gradient reach. Sediment input should decrease to a new baseline level when vegetation is reestablished on site. Since this increase in sediment is not expected to accumulate in a low gradient section immediately below the activities but disperse further downstream, the bankfull/width ratio of the particular streams is not expected to increase.

Bankfull width/depth ratios can also increase on segments of stream both upstream and downstream of new road crossings due to excessive livestock use that can breakdown streambanks and increase stream width and decrease stream depth. There are three new crossings proposed. The new stream crossings are on relatively steeper terrain that does not encourage livestock use. Therefore, no livestock use of the crossings is expected. As well, road decommissioning would limit access of livestock to any of the reestablished streambanks where culverts have been removed. For these reasons, under this alternative, no increases in the ratio are anticipated.

No activities within the RHCA of the South Fork of Lost Creek are proposed under this alternative. INFISH RHCAs would prevent any stream channel modification from upland timber harvest through the filtering of any overland soil movement and protection of streambank integrity. Under this alternative, road construction, within

the riparian area on NFS lands, would modify the segments of streams within the crossing corridors. Any modification of the existing bankfull width/depth ratio at the proposed newly constructed road crossings would be located in the riparian areas of intermittent and non-fish bearing perennial streams. This alternative with its associated isolated modifications of stream channels on NFS lands should not, when considered with stream conditions affected by private logging and road building, detrimentally affect functioning channel habitat in each subwatershed within the analysis area because of these reasons.

Embeddedness

Establishment of RHCAs, per INFISH, would adequately filter out any soil movement from most of the proposed activities. Direct or indirect sediment input may occur only where newly constructed road crossings and culvert removal occur within riparian vegetation. This alternative proposes to construct 3 crossings and remove 6 culverts on intermittent and non-fishbearing streams.

Any direct and indirect sedimentation from riparian road crossing construction and culvert removal is expected to be reduced after the actual proposed activity occurs and sites are revegetated.

All new road crossings and culvert removals are proposed in non-fishbearing streams. These specific roads are proposed for closure or obliteration, eliminating any increase in cattle access into riparian areas where active grazing allotments exist, and the accompanying soil compaction and bank trampling which can become a consistent source of sedimentation into adjacent stream systems.

Road construction and the removal of culverts during decommissioning, within the riparian area, would cause a temporary increase in sediment introduction into certain low gradient segments of streams within the project area. These sediment sources, in addition to any contribution of sediment from logging on private lands, may temporarily increase the embeddedness level of streambed substrate and filling of pool habitat on low gradient sections of streams located downstream of the proposed activities within riparian areas on NFS lands. Sediment entering a stream can fill interstitial spaces within spawning gravels and other size substrate that is used for hiding cover for fry and juveniles and habitat for macroinvertebrates. Increased levels of sediment can reduce the quality of aquatic habitat or eliminate the habitat altogether.

The obliteration of a section of FS Road 2700005 within the RHCA of Ruby Creek should have a slightly positive effect on fish and fish habitat downstream and adjacent to the project site. The closure and revegation of the road surface should reduce any contribution of sediment into Ruby Creek. In the long term, riparian and upland vegetation on the former roadbed should increase the functioning of the RHCA to provide shade, filtering and a recruitment source of large woody debris. No short or long term negative effects are expected from this proposed project since this section of road would be lightly ripped, seeded immediately afterwards and planted with trees and/or shrubs the same season.

Riparian Vegetation

This alternative is not anticipated to affect the function or quantity of riparian habitat within the analysis area. New road crossings on NFS lands are located in the riparian areas of intermittent and non-fish bearing perennial streams. The cumulative effect of this decrease in riparian vegetation on NFS lands, when considered with current quantity and quality of riparian vegetation due to logging and road construction on private lands, is considered minor when compared to the amount of remaining riparian vegetation and the riparian vegetation that would continue to mature and become more functional on past units with riparian harvest on NFS lands. The function of riparian vegetation for shade, bank stability, detritus, large instream wood, cover and to filter out soil movement should continue to be adequate for fish populations on NFS lands in the analysis area.

Fish Populations

Fish populations would continue to be represented primarily by eastern brook and westslope cutthroat trout which are tolerating fair instream conditions (low frequency of pools, high embeddedness level). Westslope cutthroat populations would continue to be located in the higher gradient stream segments where stream and riparian habitat conditions are less degraded.

This alternative is anticipated to affect the fish population of Ruby Creek primarily through the contribution of sediment-laden waters from project activities in some of its subwatersheds. The effect of the contribution, however, is likely to be minor when compared to the background level of erosion and other contributors to embeddedness, particularly roads throughout the analysis area.

Under this alternative, road-crossing construction, within the riparian area on NFS lands, would cause a minor decrease in the amount of functional riparian vegetation along a few certain segments of streams within the project area. A slight increase in sediment introduction at these few sites would occur as well. These potential effects, when considered in addition to any decrease in riparian vegetation and increase in sediment input due to past and future logging and road construction on state or private lands, would temporarily cause a minor decrease in the quality of fish habitat adjacent and downstream of the activities. This temporary degradation of spawning and rearing habitat would occur as the result of the filling of interstitial spaces of the streambed substrate with fine sediment.

Riparian vegetation would continue to mature and become more functional on past units with riparian harvest on both private and NFS lands. The function of riparian vegetation for shade, bank stability, detritus, large instream wood, cover and to filter out soil movement should continue to maintain adequate habitat for fish populations on NFS lands within the analysis area. However, fish habitat on the lower gradient reaches of the analysis area would continue to accumulate sediment from private, state and NFS lands. This accumulation of sediment would maintain the poor quality and limited quantity of spawning and rearing habitat in these lower reaches.

Hydrology

Existing Condition

Portions of South Fork Lost, North Fork Ruby, Ruby, and Reynolds Creeks are located within the Misery Lake analysis area. Misery Lake is a small lake that covers about 6 acres and drains northeasterly into Reynolds creek, which is tributary to the Pend Oreille River. Other unnamed and intermittent streams (face drainages) drain from the analysis area into the Pend Oreille River. Many wetlands, both identified and unidentified exist in the analysis area. See maps of the analysis area in appendix B.

The four named watersheds are well forested with a few natural openings (meadows) in the lower portion of Ruby Creek. The area was extensively roaded, logged, and burned in the early part of the century and has mostly revegetated. However it is estimated that some riparian areas lack the large conifers that once grew there. These conifers provided large woody debris and shade to the creeks that is still lacking. For the most part, the stream channels are stable from lateral and vertical migration. While there are scattered small parcels of private ownership within the analysis area, direct impacts to riparian areas on the forest are limited to roads and livestock activity.

Water quality data collected on S. Fork Lost and Ruby creeks at the Hwy 20 crossing and at the Forest boundary at various times since 1976 have shown elevated stream temperatures and fecal coliform bacteria and depressed dissolved oxygen compared to the Washington State Water Quality Criteria. These elevated temperature data probably reflect past riparian harvest and would likely continue until conifers replace the shade that once existed. The dissolved oxygen readings may reflect saturation due to elevated stream temperature and barometric pressure. The state has not placed either S. Fork Lost or Ruby Creek on the Clean Water Act 303(d) list of impaired waters because the data, while elevated, have not met the listing criteria. The North Fork Ruby Creek data is limited to data from 1994 and 1995. Two turbidity readings were elevated but the cause is unknown. The area is grazed by livestock in the Ruby Creek allotment and there is beaver activity above the 2700423 road crossing in North Fork Ruby Creek. Either of these activities could have caused the increase. Reynolds Creek and the unnamed drainages tributary to the Pend Oreille River have small areas on the Colville National Forest, have little or no roaded access, and have no known water quality data.

Other water quality data collected on S. Fork Lost and Ruby creeks such as: Specific Conductance, pH, Suspended Sediment, Total Dissolved Solids and Turbidity have met the state criteria where applicable.

Due to several of the streams on the forest not meeting Washington State Water Quality Standards, the Washington State Department of Ecology (DOE) wrote a Total Maximum Daily Load (TMDL) (Water Cleanup Plan) document in June of 2005 as required by the Clean Water Act. The document covered all exceedances of the Temperature, Bacteria, pH and Dissolved Oxygen criteria on the Colville National Forest and set "Daily Loads" for 13 Temperature and 13 Bacteria sites. S. Fork Lost and Ruby creeks were both listed for Temperature and Bacteria. The "Daily Loads" are the state standards and the Implementation Plan of October 2006 requires annual reporting of improvement activities to the DOE.

As a result of the TMDL, regular field visits were made by the Forest Hydrologist to the analysis area (S. Fork Lost and Ruby creeks) every 10 days during the months of June, July, August and September of 2006 and 2007. Water samples were taken and a submersible thermograph used to record continuous water temperatures. In addition, a field visit was made to the 2700056 road on June 19, 2006 to look for road impacts on the riparian resource. On June 8, 2007 a field visit was made to the 2700005 road to look at the proposed road relocation. On July 5, 2007 a field visit was made to the 2700050 road looking for road impacts. The same road was visited on September 12, 2007 to look at the proposed new crossings of Reynolds Creek tributaries in Section 23. A field visit was made to the stream crossing on the 4100435 road in section 14 that would be rehabilitated after the project. This analysis reflects information gathered during those field visits.

The analysis area has a history of extensive high-intensity wildfire in the 1930s which consumed much of the woody vegetation including trees in riparian areas. Revegetation has been mostly alder in the riparian areas and lodgepole pine in the uplands. Several field visits to the area in 2006 and 2007 have shown that much of the riparian areas of the analysis area, while fully stocked with alder, is lacking in adequate shade from coniferous vegetation. Eighty percent shade is desirable to meet water quality standards and many areas currently have much less shade[28]. Alder that occupies the stream banks receives some minor browsing and trampling damage from livestock activity in several areas. This damage is not extensive but the bank trampling does contribute to accelerated sedimentation. Past extensive wildfire also results in the quantity of large woody material (logs) in the channels to be less than what would be expected under a stand of coniferous trees.

The analysis area contains the Ruby Creek Livestock Allotment which currently permits 155 grazing pairs of livestock.

The parent material (geology) of the area contains a large amount of decomposed granite which contributes sand, silt, and clay into the streams. Stream surveys indicate elevated cobble embeddedness compared to other streams on the forest. Much of this occurs from channel sources during spring runoff and storm events, but some minor accelerated erosion and sedimentation is due to human activity in the watersheds. Field observations indicate that this accelerated sediment is difficult to quantify and separate from natural sources. Pend Oreille County road 2489 is within the riparian area of Ruby Creek for about 2 miles and forest road 2700423 parallels North Fork Ruby Creek for another 2 miles. These roads are unsurfaced and their use during wet or very dry weather mobilizes or loosens fine sediments that sometimes reach Ruby Creek. Regular road maintenance by the Forest Service and the US Air Force maintains drainage structures, adds spot surfacing, and minimizes sedimentation.

While in-channel erosion and sedimentation is considered natural, the desired management objective is to eliminate as much as possible the accelerated sedimentation from human activity which usually comes from existing unsurfaced roads and trails.

Effects of Alternatives A and B
The 'No Action' alternative A would result in no change from existing conditions.

The 'Proposed Treatments' alternative B would result in little observable change in existing watershed conditions. Livestock grazing would continue but there would be little change in the amount of livestock access to riparian areas since vegetative treatment would not occur there.

[28] CNF temperature TMDL information is located in the Misery Lake EA analysis file.

There would be approximately 4.8 miles of new road construction with 3 new stream crossings, 18.9 miles of light reconstruction and 1.9 miles of medium road reconstruction. This road reconstruction would range from occasional drain dip construction to occasional rocking to improve subgrade strength and sediment control. It is estimated that about 40% of the road length listed for light reconstruction would actually have some work completed on it. Road reconstruction would be planned to minimize or prevent any mobilized soil from reaching drainageways. The proposed new road construction (road 2100107) in Section 21 would relocate a road and obliterate the present road that is causing sediment to enter Ruby Creek.

The proposed new road in Section 23 crosses three tributaries of Reynolds Creek. These new crossings would be culverts that would be designed to pass the 100-year flow. At the present time all of the creeks are dry, but the first two were classified as ephemeral/intermittent and the third one as intermittent.

There would be approximately 0.5 miles of temporary new road construction[29] and eight miles of existing road that would be decommissioned after the timber sale. None of the temporary road construction would be within or adjacent to riparian areas. The decommissioning would involve closing, ripping, and culvert removal in places. The decommissioning of the 3100433 road in Section 17 would include some streambank rehabilitation and revegetation.

The effects of this roadwork on the riparian resources would be minimal but would cause some accelerated short-term sedimentation. Overall, the effects of the new road construction and reconstruction would be offset by the restoration effects of the road decommissioning. Best Management Practices (BMPs) would be used for the culvert installations which are designed to minimize accelerated sedimentation. The proposed new roads would not be located in riparian areas except for the three stream crossings.

Environmental Consequences
Similar treatments of harvesting and fuels treatments by machine and burning have been visually monitored for many years on the Colville National Forest. It has been concluded that the treatment types have had little effect on streamflow and channel stability in the area. Soil disturbance caused by the harvest treatments is generally minor, and eroded or displaced soil is trapped by litter on the forest floor before entering ditches or streams. Monitoring of current harvesting in the Lost Creek area today confirms the lack of surface movement of eroded or displaced soil.

Current new road locations avoid paralleling riparian areas, and stream crossings are stabilized with rock surfacing before use. This technique has a huge effect in preventing accelerated sedimentation into streams from unsurfaced roads. It is further concluded that current harvesting and road construction techniques minimize impacts to water quality by stabilizing disturbed soil on site. Alternative B would build approximately 4.8 miles of new roads and reconstruct 20.8 miles of existing roads. Alternative A would result in no new effects from the existing situation.

The 3 new stream crossings proposed in Alternative B have the potential to add minor quantities of accelerated sediment to the streams during construction. However, this potential is low since the streams would probably be dry at the time of road construction. Sedimentation impacts can be mitigated and almost entirely eliminated by the use of road BMPs designed to protect water quality. Such crossing installations have been visually monitored in the general vicinity of the analysis area and BMP effectiveness is observed to be high.

Livestock impacts to the riparian areas are not expected to change due to the proposed alternative. Fecal coliform pollution appears to be correlated to the time livestock spend in riparian areas. Since physical access to riparian areas is not expected to change, the effects of the alternatives on fecal coliform levels is not expected to change. Additional range management BMPs are not part of the proposed project.

The proposed alternative would not detrimentally affect identified wetlands since the plans to treat riparian areas would be guided by the INFISH policy and have been discussed in the field. If wetlands not currently mapped on

[29] Location of new roads and roads for decommissioning is displayed on maps in Appendix B.

the Alternative B proposal map are identified during timber sale layout they would be avoided for harvest according to the INFISH policy.

Since the project is expected to have no adverse effect on the existing water quality, quantity or timing of flow, the Antidegradation provision (section 319) of the Clean Water Act would not be affected. A separate Antidegradation analysis is unnecessary because the effects analysis indicates that the beneficial uses would be fully maintained. The existing water quality conditions while slightly elevated for temperature and fecal coliforms are being addressed by a forest-wide TMDL analysis by the Washington State Department of Ecology. This project is not expected to change either of these two water quality parameters.

BMPs are listed in a separate document and would provide the needed mitigation and protection of water quality. BMP effectiveness is estimated for each BMP listed based on the effectiveness observed of the same BMP on similar projects. The Washington State Department of Ecology has certified Forest Service BMPs as adequate to protect designated uses and maintain state water quality standards.

Cumulative Effects
It is not expected that there would be adverse cumulative effects to the water resources due to this project. The headwaters of S. Fork Lost and Ruby Creeks are almost entirely in Forest Service ownership with only small portions of State and private land. The treatments in the face drainages to the Pend Oreille River are not expected to cause adverse sedimentation or water quality problems due to the small size of the drainages. The known private land timber harvests in the vicinity have been reviewed and would not be expected to cause any cumulative adverse watershed conditions to the creeks named above when combined with the proposed action alternative.

Alternative B would meet the Forest Plan standards and guidelines, and all applicable laws, regulations, and policies.

Soils

Existing Condition
At a landscape scale, the existing detrimental soil conditions are very low. Most of the detrimental soil conditions that have occurred are limited in extent, intense, but widely scattered and do not occupy a large percentage of the analysis area.

- The Misery Lake analysis area includes about 48 miles of authorized[30] roads, and 17 miles of known unauthorized[31] roads. Roads occupy about 3% of the analysis area. These roads are a long-term detrimental soil condition.
- Past regeneration timber harvest (clearcut, seedtree, shelterwood) occupy about 5% of the analysis area. Detrimental soil conditions in these areas are variable – ranging from about 5% to 20% of the harvest unit.
- Powerline right-of-way occupies about 1.5% of the analysis area. Detrimental soil conditions are about 25% within the ROW (including roads).
- Past fires and homesteading have impacted the soil, but detrimental conditions are not apparent today.

Overall, existing detrimental soil conditions are very low. Every proposed timber harvest unit was examined for evidence of detrimental soil conditions from past and on-going activities. In most units the existing detrimental soil conditions are less than 5%. Many of the units have no measurable detrimental soil conditions. The following table describes the areas with the higher levels of detrimental soil conditions. These areas of higher levels of DSC make up about 2% of the analysis area.

[30] *Authorized roads* are roads within National Forest System lands planned or managed for motor vehicle access including state roads, county roads. (36CFR 212.1)
[31] *Unauthorized roads* are roads that are not intended to be part of, and are not managed as part of, the National Forest transportation system such as unplanned roads, off-road vehicle tracks, or abandoned travelways. (36 CFR 212.1)

Table 12. Areas with Higher Levels of Detrimental Soil Conditions (DSC)

Area	Existing DSC	What is causing the higher levels of DSC
Stands along NF Ruby Creek (vicinity of proposed unit 3)	About 10-15%	Mostly livestock use, in combination with some old homestead clearing activities. About 75 acres total.
Stands along Ruby Creek in the vicinity of the Black Bridge (vicinity of proposed units 44, 45)	About 10-15%	Roads in combination with livestock and OHV use. About 50 acres total.
Stands around Squirrel Meadows (vicinity of proposed units 64 and 65)	About 5-10%	Old, abandoned roads in combination with livestock and OHV use. About 103 acres total.

Effects of Alternative A

By deferring treatment at this time, alternative A poses no short-term impact to soil resources. Soil conditions and processes would remain essentially as they are. There is probably more duff and forest floor material than occurred under historic conditions. This material would continue to build-up until it eventually burns.

Potential adverse effects of an uncontrolled wildfire

The location, size, and intensity of future wildfires are difficult to estimate, though some generalizations can be made. Generally uncontrolled wildfires occur during the driest time of the year, yielding a more intense fire that would occur under prescribed fire conditions. The adverse effects of an intense fire – loss of duff and forest floor material, increased erosion, changes in soil biota – would be more widespread in an uncontrolled wildfire than under a prescribed fire.

The primary impact of an intense fire on soil productivity is increased erosion. Increased erosion is due to increased exposure of mineral soils (litter and duff burned off), the development of water repellent conditions, and destruction of soil aggregates[32]. Robichaud and Brown (1999) measured erosion rates for 4 years following a wildfire in eastern Oregon. Mean annual erosion rates were highest in the first year (mean average 38 Mg/ha). Erosion rates declined sharply through the following years (mean average 2.3 Mg/ha year 2, 1 Mg/ha year 3, 0 Mg/ha year 4).

If the organic matter of the mineral soil is reduced (as happens with a high-intensity, long-duration fire) the cation exchange capacity of the soil is also reduced and the ability of the soil to retain nutrients leached from ash decreases (Harvey et al. 1994). The soils in this analysis area have volcanic ash in the soil surface, which has a high cation exchange capacity. While removal of organic matter would reduce overall cation exchange capacity, these soils would retain more capacity than most forest soils.

High intensity fires may volatilize some chemicals that are plant nutrients – specifically nitrogen and sulfur.

Typically cation plant nutrients (e.g., potassium, calcium, etc.) do not volatilize at temperatures found in fires, they remain on the site in the ash (Downer and Harter, 1979). These cation nutrients may be lost through leaching. These nutrients would eventually be replaced from the decomposition of rocks.

Several researchers have suggested that fires, especially moderate and high intensity fires, can have a profound effect on soil arthropods, soil microbiology, and nutrient cycling. Visser and Parkinson (1999) found that severe wildfires in the boreal forests of Alberta killed most of the fungi species studied, and that it took about 65 years for the fungal community to recover. Amaranthus and Louma (1995) found that fires killed mycorrhizal fungi. Hungerford and others (1991), in a review of literature, report that burning kills many kinds of bacteria, fungi,

[32] Organic matter is important in stable soil aggregates. High soil temperatures burn the organic matter in the soil matrix, leaving the soil in an 'ashed' condition. Ashed soil is a fine powder that has lost its natural cohesiveness and is highly erodible. This characteristic has been observed on the Leona Fire and Togo Fire, both on the Colville National Forest.

and arthropods but the extent of this effect is dependent on the amount of heat generated by the fire and the moisture content of the soil. Also, the effect may be short-lived.

Effects of Alternative B

The typical impacts associated with the proposed activities are soil compaction, surface erosion, soil mixing and displacement, loss of organic material, loss of soil nutrients, and changes in soil biology. Severely burned soils, as defined under the Forest Plan[33], are rarely encountered due to the proposed activities. Full analysis for each type of proposed activity is located in the Soils Analysis Report, located in the project analysis file.

Compaction

Compaction is an increase in the bulk density of a soil. Compaction is accompanied by an increase in soil strength, and a decrease in the size and number of pores. Compaction occurs when equipment crosses the ground, vibrating and compressing the soil. Compaction adversely effects soil productivity and ecosystem processes by a variety of mechanisms including increasing the resistance to root penetration and elongation, changes in air and water movement through the soil, and subsequent changes in soil processes (e.g., soil microbiology, and nutrient cycling).

Definition: Detrimental compaction is defined by the Colville National Forest as an increase in bulk density of 15-20% over the undisturbed level, and macropore space reduction of 50% or more (Forest Plan FEIS glossary pg. 11).

The degree of compaction can vary widely depending on –

- logistics of the operations -- the number of times a piece of equipment passes over the same piece of ground,
- the type of equipment used -- the size, weight, and type of wheels or tracks, and the
- soil and site conditions -- rock content of the soil, soil moisture conditions, and the presence of ameliorating conditions such as frozen soil, snow, or logging slash. (Alexander and Poff, 1985).

Equipment may not always cause detrimental compaction. Light equipment making a single pass, especially if the duff and forest floor are intact, may not increase bulk density by the 15-20% necessary to constitute a detrimental soil condition (Froelich, 1974; Amaranthus and Steinfeld, 1997; Froese, 2004). In north Idaho, Page-Demroese (1993) found that 4 passes with a D6 increased bulk density on ashy soils[34] by more than 20%. Amaranthus and Steinfeld, using a John Deere 450E on dry soil, found bulk density had only increased by 7% after the third pass. However, the soils had a beginning bulk density of 1.3 gr/cm^2 -- much higher bulk density than the typical soils in this analysis area. Han-sup Han (2006) measured changes in soil strength with multiple passes by a cut-to-length (CTL) system. He found that a single pass of a harvester on slash did not increase soil strength at the 10 cm depth (4 inch), but did at the 20 cm depth (8 inch). Slash appeared to be effective in minimizing soil compaction for the first 2 to 3 trips of a fully loaded forwarder.

Soils may remain compacted for a long time. Froelich and others (1985) found that surface layers decompacted in central Idaho tractor skid trails, but subsurface compaction remained after 23 years. In a summary of the literature, Alexander and Poff (1985) noted that under natural conditions mildly and moderately compaction can be ameliorated by shrink-swell due to wetting and drying cycles, frost action, and biologic activity. Deep compaction, such as found in roads and landings, may never dissipate without physical intervention like subsoiling.

[33] Soils are considered to be detrimentally burned when the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one-half inch blackened from organic matter charring by heat conducted through the top layer. The detrimentally burned soil standard applies to an area greater than 100 square feet, which is at least five feet in width.

[34] Priest River Experimental Station – ashy soils very similar to the soils in this analysis area.

Compaction may occur as the only detrimental condition (for example, a CTL trail where the duff and soil cover remains intact), or it may occur in conjunction with erosion and displacement (such as may be found on a main skid road or landing).

Machine piling is done with a grapple on an excavator or similar piece of equipment. The equipment sits on already disturbed areas – roads, skid trails, CTL trails. Grapple piling is expected to increase the amount of detrimental soil compaction in CTL units by about 1 to 2%. Total detrimental soil conditions in areas treated with a CTL system and machine piling would be about 10-11%.

In helicopter and skyline units, this equipment would be held to the same spacing at a CTL system. Grapple piling would increase detrimental soil conditions by about 1-2%; total detrimental soil conditions in these units would be about 1-3%.

Erosion

Surface erosion is the detachment and transport of individual soil particles by wind, water, or gravity. Surface erosion can occur as the loss of soil in a fairly uniform layer (sheet erosion, dry ravel), or as concentrated erosion (rills and gullies). Erosion is a natural process. Severe erosion removes nutrient-rich topsoil, thereby reducing soil productivity.

Definition: Detrimental erosion is visual evidence of surface loss in areas greater than 100 square feet, rills or gullies and/or water quality degradation from sediment or nutrient enrichment. (See FSM 2532).

Human activities can increase surface erosion by –

- Baring the soil. Most erosion occurs on bare soil, and providing soil cover effectively prevents erosion.
- Compacting the soil, concentrating water. Rills and gullies often form when concentrated water meets unprotected soil.

Erosion may be the only detrimental condition present (for example, bare eroded soil due to a severe burn) or may occur in conjunction with detrimental compaction or detrimental displacement (for example, on a skid road or landing).

Ketcheson, Megahan and King (1999) noted that "Numerous studies have shown that most sediment resulting from timber harvest activities is caused by erosion on forest roads associated with the harvest rather than by erosion on the areas disturbed by tree cutting and skidding." Erosion on roads and landings occurs in conjunction with other detrimental soil conditions -- compaction and displacement. Best Management Practices are used to control the off-site movement of this material.

CTL trails are typically covered with slash and do not erode.

Skyline yarding can also result in bare ground in some of the cableways where suspension is not achieved – typically just below the landing. Each unit was reviewed, and suspension considered on a case-by-case basis. Where suspension is adequate, bare ground is not expected to exceed 1-2%. Detrimental erosion is not expected to occur because these areas do not meet the size criteria. Observable erosion in cableways is not common (Nancy Glines, personal observations) because they are usually small and have some slash scattered on them.

Machine piling typically leaves small material, duff and forest floor material in place. Burning the piles often creates areas of bare soil, but they are too small to meet the criteria for a detrimental soil condition.

Soil displacement and mixing

Soil displacement is the lateral movement of soil from one place to another by mechanical forces such as equipment blades, vehicle traffic, or logs being yarded. Mixing is when the organic surface horizon is physically mixed with the mineral soil below – usually when logs are yarded. Some mixing occurs in unmanaged stands due to animal activity and windthrow. Minor mixing is not considered a detrimental soil condition.

Definition: Detrimental displacement is the removal of more than half of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width. (See FSM 2532).

Displacement generally occurs on roads, landings and skid trails in conjunction with detrimental compaction and erosion.

Soil displacement on roads, landings, and skid trails occurs in conjunction with other detrimental soil conditions – compaction and erosion. CTL systems typically ride over the forest floor and do not cause detrimental displacement.

Skyline and helicopter yarding do not cause detrimental displacement. Studies have found skyline yarding causes mixing. Dryness (1967) found skyline harvesting disturbed about 6% of the site. Smith and Wass (1977) measured 7.6% disturbance. McIver and others (1998) measured about 7% disturbance under skyline yarding systems. Most of the disturbance found was shallow disturbance to the duff and shallow mixing of duff and surface soils – not detrimental soil conditions as defined by the Forest Plan or the R6 Soil Quality Standards.

The use of a grapple to pick up only the larger woody material effectively prevents displacement from this activity. Prescribed burning does not cause displacement or mixing.

Changes in organic material, nutrients and soil biology

Timber removal and prescribed fire result in a variety of changes in soil organic material, nutrients, and soil biology. None of these changes are considered detrimental soil conditions under the Forest Plan or Regional Soil Quality Standards (FSM 2520.2 R6 Supplement 2500-98-1). Organic matter is critical for long-term site productivity and ecosystem sustainability. It should be maintained in amounts sufficient to prevent short or long-term nutrient and carbon cycle deficits and to avoid detrimental physical and biological soil conditions.
Timber removal can change soil organic material, nutrient cycling, and biology through changes in stand density and species composition. Opening up a stand can result in both soil warming and an increase in soil moisture. Soil organic material and biology naturally change through the life of a stand (Plitz and Molina, 1996).

Open stands of trees typically have less duff than closed canopy stands. The soils warm in response to increased solar radiation, the more over-story trees removed the greater the effect (Hermann, 1978; Smith, 1986). Removing trees also reduces evapotranspiration because the total biomass of living plants is reduced. This effect typically disappears quickly as other plants reoccupy the site (Stone et al., 1978). Loss of canopy and increased soil moisture increase biologic activity, and create conditions favorable to the decomposition of organic material (Grier and others, 1989).

Changes in types of fungi have been documented in stands that have been thinned, but these stands have had about the same total biomass of fruiting bodies (Waters et al., 1994). Reductions in ectomycorrhizal fungi diversity is likely where vegetation is intensively used, composition simplified, or all surface organic matter is removed or consumed (Amaranthus and Louma, 1995).

Timber removal also removes some plant nutrients from the site. Nutrient loss from the removal of the boles of trees is typically small and can be replaced through the course of a rotation (Spurr and Barnes, 1980; Grier et al., 1989). Much of the nutrients in a tree are located in the bark, limbs, and foliage (Grier et al., 1989).

The primary impact of prescribed fire is a reduction in organic material. Burning consumes some of the above-ground organic material, and may consume below-ground organic material as well. The amount consumed is related to fire severity. Prescribed fires are designed to retain forest floor and duff over most of the treated area.

Fires impact soil biology. Most bacteria and fungi are killed at relatively low temperatures – between 120º and 311º F (Busse and DeBano, 2005). Hungerford and others (1991), in a review of literature, report that burning kills many kinds of bacteria, fungi, and arthropods but the extent of this effect is dependent on the amount of heat generated by the fire and the moisture content of the soil. The effect may be short-lived, and the whether these changes represent a degradation of soil and site productivity is not clear. Low severity underburns appear to have little long-term effect on soil microorganisms (Hungerford, 1991, Busse and DeBano, 2005).

Harvey and others (1994) suggest that, if the forest floor material is not entirely destroyed, the effects of fire on soils are usually minimal. Tiedemann and others (1999) cautions against the adverse effects of prescribed fires which are too intense or too frequent. Several researchers recommend maintaining soil carbon to maintain

biologic activity (Harvey et al., 1994; Stark and Hart, 1999), and recommend maintaining a lot of heterogeneity in burned areas to provide the micro-flora and –fauna to reinvade burned areas (Moldenke, 1999).

High intensity fires may volatilize soil nutrients such as nitrogen and sulfur. Typically cation plant nutrients (e.g., potassium, calcium, etc.) do not volatilize at the temperatures expected in a prescribed fire. They remain in the ash, where they may be leach into the soil (Downer and Harter, 1979). Because of the amount of organic matter to be left on the site, significant leaching is not expected to occur.

The soils directly under machine piles generally experiences a high intensity and long-duration fire when burned. The impact on organic matter, soil biology, and nutrients may be severe, but the area impacted is very small – about 0.5% of the treatment area.

Roads

The effects of the construction of roads and landings

Regardless of soil type and site conditions, detrimental soil conditions occur on roads and landings. The construction of roads and landings is considered an 'irreversible effect' on soil productivity as described in 40 CFR 1502.16. Roads and landings can be obliterated and some productivity restored; however, full productivity would not be restored for many years until organic matter is restored, soil tilth has redeveloped, an A horizon develops, and soil processes are restored (Brady, 1974).

By constructing new permanent specified roads, the proposal would reduce productivity on about 29 acres. None of the proposed new road construction is located on existing unauthorized roads. These roads would not be scarified and seeded, so soil productivity would be severely diminished on the road prism for the foreseeable future.

The proposal would impact an additional 1.5 acres through the construction of new temporary road, and about 20 acres through the construction of about 70 new landings. Temporary road and landings would be scarified and seeded restoring some productivity to these sites.

The effects of decommissioning and obliterating roads

The proposal would decommission about eight miles of existing specified NFS roads. Decommissioning includes closing the road to use, removing all drainage structures that require maintenance (e.g., culverts), installing cross-drains or outsloping the road so it drains well, and allowing the road to revegetate. Decommissioning (obliteration) may also include ripping the roadbed to reduce compaction, pulling the fill slope to restore the hillslope topography, and planting vegetation.

Decommissioning without ripping would not restore site productivity. Road obliteration is generally considered the first step in restoring the productivity of forest roads. If accomplished correctly, ripping can reduce erosion and increase infiltration. However, obliterated roads can still produce sediment (Luce et al. 2001). Compaction does not return to undisturbed levels, and the saturated infiltration rate of ripped roads does not return to the rate found in undisturbed sites (Luce, 1997). Not all sites are well suited for obliteration. In very rocky areas it may be virtually impossible to effectively rip the roadbed. Clayey soils don't rip very well – they just congeal when they get wet again. Very sandy areas may be difficult to stabilize and revegetate. If the road doesn't have any fill material, it is difficult to reshape the slope though you can still rip the roadbed. It may be difficult to stop erosion on steep grades.

Forest Road 2700005 (0.6 miles) is the portion of the road being relocated. The road is moderately steep in the first part as it rounds two switchbacks, then is flat along the creek. The soils along this segment include Moscow silt loam (around the switchbacks), and Kegel loam on the flat along the creek. Recommendations for this site include ripping, recontouring, planting, and mulching. This should begin to restore soil productivity to this roadbed.

Forest Road 2700006 (0.4 miles) is located within proposed unit 44 and would be used to log the unit. Road 2000006 is currently closed by lack of use and lodgepole pine falling across the road. The road is located on a flat bench of Bonner silt loam. Recommendations for this road include ripping and planting. This general area

receives a lot of OHV use, but this specific road has not been used in the past. Decommissioning should begin to restore soil productivity to this roadbed.

Forest Road 2700008 (0.3 miles) extends from FR 2700004 down to a popular dispersed camping area on Ruby Creek. The road grade is moderately steep in the upper part, and flattens near the creek. In the middle section, the road descends an escarpment, and the soil is gravelly sand. Recommendations for this road include closing at the top before it gets into the sandy material, and ripping the remainder of the road.

Forest Road 2700026 (0.3 miles) is the last portion of a road accessing proposed unit 54. The road is rocky and located in an upland area. It has not been used recently by motorized vehicles, though there is some use of the lower segments. The road would be decommissioned by berming and allowing to continue to vegetate.

Forest Roads 3100430, and 3100445 (0.6 miles) are very old roads, and parts are already heavily vegetated. They are located on a terrace of Kaniksu sandy loam adjacent to Squirrel Meadow. They are little used except by livestock and occasional OHVs. Recommendations for these roads include closing and letting them continue to revegetate naturally.

Forest Road 3100433 (2.9 miles) is the old road in the Squirrel Meadows area. This project would decommission the entire road. Road 3100433 currently is closed, but segments have continued to receive some OHV traffic, especially from adjacent landowners. The segment from FR 3100430 to 2700057 (0.3 miles) crosses Squirrel Meadows, and receives light OHV traffic. This segment is recommended to be aggressively blocked and left to revegetate naturally. The segment from FR 2700057 to 2700050 (0.6 miles) is an upland area. This segment of road has been aggressively closed with large 'Kelly humps', and does not appear to receive OHV use. The road grade in this segment is moderately steep. Recommendations include ripping this segment of road. The segment from FR 2700050 to 2700050 (1 mile) loops to the west of the 050 road. Most of the road in an upland area, but the last ¼ mile is located on the edge of McElroy Meadow. This segment has been closed with 'Kelly humps', but continues to receive light OHV use. The road grade is flat to rolling. The soils are Newbell silt loam, but are rocky in some places. Ripping is recommended for the suitable areas (not the rocky areas). The segment from FR 2700050 to the west boundary of unit 56 (0.8 miles) is located on the floodplain of a perennial stream. The road fords the creek and is very muddy in several places. This segment receives moderate OHV use and livestock use. Recommendations include closing and leaving it to revegetate naturally. This should begin to restore soil productivity to portions of this roadbed.

Forest Roads 3100435 and 3100440 (0.6 miles) are very old roads. They are located on a southern aspect; the soil is Newbell stony silt loam. Because of the aspect and grade, the recommendation is to close them and let them continue to revegetate naturally.

Commercial Timber Harvest

The effects of commercial harvest ground-based system, followed by underburning.

These effects apply to about 960 acres (units 4, 6, 7, 8, 9, 10, 11, 12, 17, 19, 23, 25, 27, 37, 46, 54, 56, 57, 60, 61, 62). The primary impact from these treatments is compaction and erosion which is generally limited to designated skid trails. Most of the proposed ground-based units are dominated by soils that are easily compacted when moist and easily rutted when wet.

Compaction: The project requires all heavy equipment to remain on designated skid trails. Therefore, additional compaction off of designated skid trails would not occur in these units. Because of the slash, it is unusual for equipment to venture off of CTL trails.

Erosion and Sedimentation: Cut-to-length machines that place a mat of slash before them do not bare the soil and subject it to erosion (personal observation). Erosion is rarely observed on CTL trails. The proposed underburning must be of a low-intensity to avoid killing large numbers of over-story trees. The fires prescribed are expected to burn the duff and litter in small, discontinuous areas throughout the prescribed burn areas. Because of their small size (<100 square feet) these areas are not expected to degrade long-term site productivity.

Soil biology and nutrient cycling: This project proposes shelterwood (HSH), commercial thinning (HTH) and selection harvest (HSL) prescriptions. Because of the Regional Forester's Amendments (screens) the trees to be

removed are less than 21-inches dbh. Over-story trees would generally be left. It is unlikely the proposed treatments would reduce crown cover enough to influence soil temperature or water regimes (Hermann, 1978).

The changes in soil temperature, moisture regime, and the amount of organic matter are not detrimental to long-term site productivity. This kind of burn would not have a long-term adverse impact on soil biota.

This project does not propose to simplify composition. Logging and tree removal alone does not remove the organic material on the forest floor. This project retains the larger trees, which when they die and fall down provide the refugia needed especially on drier sites.

The prescribed fire proposed would be light intensity with small areas of medium intensity, retaining unburned islands. This kind of burn would not have a long-term adverse impact on soil biota. The fire intensity proposed would not be high enough to volatilize a significant amount of these plant nutrients. Typically cation plant nutrients (e.g., potassium, calcium, etc.) do not volatilize at the temperatures expected. They remain in the ash, where they may leach into the soil (Downer and Harter, 1979). Because of the amount of organic matter to be left on the site, meaningful leaching is not expected to occur.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be from compaction. A small amount would occur from erosion from underburning. Overall detrimental soil conditions would be about 9-11% from these treatments.

The effects of commercial harvest using a ground-based system, followed by mechanical fuel treatment and fuels/fire treatment (e.g., prescribed fire)
This treatment combination would apply to about 1,400 acres (units 5, 16, 18, 21, 26, 28, 30, 31, 32, 34, 38, 39, 40, 41, 42, 43, 50, 53, 58, 59, 63, 64, 65, 68). The primary impact is compaction which is generally limited to designated skid trails. The primary impact from these treatments is compaction which is limited to designated skid trails.

Compaction: Most of the proposed units include soils with a high compaction potential when moist. Units 30 and 31 are found on soils with a moderate potential for compaction.

Erosion and Sedimentation: Grapple piling generally leaves the duff and forest floor material intact. Additional erosion is not expected from this operation.

Following harvest, equipment would be used to cut and remove sub-merchantable material. This equipment would be limited to the CTL trails used for the commercial harvest. This additional use of the CTL trails is expected to increase compaction on secondary trails slightly.

Soil biology and nutrient cycling: Machine piling and mastication would leave the duff and forest floor intact. Mastication would add 1 to 2 inches of small woody pieces; in the short-term decomposition of this new woody material would reduce nitrogen available for plants. The masticated material would enhance long-term site productivity by increasing soil organic matter, and reducing the risk of weed infestations. The soil directly under machine piles would experience a high intensity, long-duration fire; impacting 0.5% of the treatment area.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be from compaction. Overall detrimental soil conditions would be about 10-12% from these treatments.

The effects of commercial harvest using a ground-based system, with no further fuel treatment
These effects apply to unit 49 (9 acres). The primary impact would be compaction from skid trails and a landing.

Compaction and erosion: It has been logged in the past (stumps evident), but few skid trails were observed. There is nothing unique about this unit with regard to the proposed treatment. The road along the top could be used as a landing.

Soil biology and nutrient cycling: The duff and forest floor would remain intact.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be from compaction. Detrimental soil conditions are expected to increase to about 8-10%.

The effects of commercial harvest using a ground-based system in the winter, followed by mechanical fuel treatment
This treatment combination would apply to **unit 3** (75 acres). The primary impact is slight compaction from the mechanical fuel treatment. The unit extends along FR 2700423 for about a mile and is about 800 feet wide.

Compaction: The vegetation is young ponderosa pine, lodgepole pine and some Douglas-fir. This vegetation would not generate enough slash to adequately protect the CTL trail in the summer. Snow and frozen soil conditions can result in much lower compaction levels (personal observations, Alexander and Poff, 1985). Logging is not expected increase detrimental soil compaction within this unit.

Following harvest, machine piling would occur using a grapple. Post-harvest harvest equipment would be used under dry soil conditions. The equipment is usually lighter than yarding equipment.

Erosion and Sedimentation: Erosion is not expected from this operation.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be compaction. Overall detrimental soil conditions would be about 0-5% from these treatments.

The effects of commercial harvest using a ground-based system, followed by mastication and ripping
This treatment combination would apply to about 50 acres (**units 44 and 45**). The primary impact would be compaction which would be limited to small portions of CTL trails that cannot be ripped.

Units 44 and 45 are located on a low terrace of Bonner silt loam. Slopes are less than 10%. The surface is ashy, about 10-12 inches thick. The subsoil is gravelly sandy loam with about 10% cobbles. This material is suitable for ripping.

Compaction: Following harvest, fuels would be masticated with heavy equipment. Post-harvest harvest equipment would be used under dry soil conditions. The equipment is usually lighter than yarding equipment.

Following mastication, skid trails, landings, and road 2700006 would be ripped with winged-rippers to a depth of about 12-15 inches. The ripping is expected to decompact the CTL trails and incorporate some masticated material into the surface soil.

Erosion and Sedimentation: Erosion from ground-based logging was described in the previous section. Mastication leaves 100% soil cover. Ripping would incorporate some of the masticated material into the surface soil, but is still expected to leave about 100% soil cover. On these slopes, no erosion would occur.

Soil biology and nutrient cycling: In addition to the forest floor material, mastication would add 1 to 2 inches of small woody pieces to the forest floor. In the short-term (3-5 years), decomposition would reduce nitrogen availability for plants on the site, then nutrient availability would return to normal levels. The masticated material would enhance long-term site productivity by increasing soil organic matter, and reducing the risk of weed infestations.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be compaction, most of which would be ameliorated by ripping. Overall detrimental soil conditions would decrease about 0-5%.

The effects of commercial harvest using a skyline system, followed by underburning.
These effects apply to about 100 acres (units 14, 22, 33, and 36). The primary impact is erosion in a few cableways, and a slight increase in erosion from the subsequent underburning.

Disturbance and erosion: Skyline yarding is expected to 'disturb' about 6-7% of the units, but the disturbance is generally shallow gouging and mixing – not detrimental soil conditions as defined by the Forest Plan or the R6 Soil Quality Standards. In addition, skyline yarding is expected to bare some soil in the cableways – exposing the soil to potential erosion. This bare ground is not expected to exceed 1 to 2% of the unit.

Skyline units occur on Aits loam 40-65% slopes (unit 33); Newbell-rock outcrop complex 40-65% slopes (units 14, 22, 33, 36); and Newbell stony silt loam 40-65% slopes (unit 22). Because of the slopes and the lack of rock,

the erosion potential is high for the units on Aits loam 40-65% slopes, and Newbell stony silt loam, 40-65% slopes.

Because of the discontinuous pattern across the landscape, these areas are not expected to contribute sediment to nearby streams.

Soil biology and nutrient cycling: This treatment would result in a stand with a great deal of diversity and the forest floor would remain intact.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be erosion in cableways, and a small amount from the burning. Expected detrimental soil conditions would remain very low, less than 5%.

The effects of commercial harvest using a skyline system, followed by mechanical fuel treatment
These effects apply to about 80 acres (units 15, 35, 66, and 67). The primary impact would be erosion in the cableways and some compaction from machine piling.

Compaction: The equipment used for machine piling is typically lighter and has less ground-pressure than yarding equipment. Grapple piling doesn't roll back and forth over the ground – it sits in one place and picks up the material. Mitigation is included to limit the extent of this equipment, and to limit operations to dry conditions. Detrimental soil compaction does occur, but not everywhere the machine goes. In addition, parts of these areas designated as machine pile are too steep for equipment. In the areas piled, about 3-5% of the ground is expected to experience detrimental soil compaction.

Disturbance and erosion: Various studies have found that skyline yarding causes some shallow mixing and displacement on the skyline corridor – but it generally doesn't meet the criteria for a detrimental soil condition. Because of the suspension, significant erosion would **not** occur in these units.

Soil biology and nutrient cycling: This treatment would result in a stand with a great deal of diversity and the forest floor would remain intact.

Total Detrimental Soil Conditions: The primary detrimental soil conditions would be erosion in cableways; and a small increase in compaction and burn impacts from the piling and burning. Expected detrimental soil conditions would be about 5-7% and would include some detrimental compaction.

The effects of commercial harvest using a helicopter, followed by underburning
These effects apply to 260 acres (units 1, 13, 20, 48, 52, and 55). The primary impact is scattered areas of disturbance to the duff and forest floor, and some potential for erosion from burning.

Disturbance and erosion: Helicopter yarding has fewer resource impacts than other yarding systems. Excluding the landing, compaction generally does not occur (Alexander and Poff, 1985; Fredrickson and Harr, 1979). Helicopter yarding produces less disturbance than skyline yarding (Dryness 1972). Under a helicopter yarding system, a group of logs is cabled together and lifted. The logs move laterally until they are airborne. Some soil mixing may occur from this lateral movement. This duff mixing would not constitute a detrimental soil condition.

Low and medium intensity fires burn only part of the duff and litter – leaving adequate soil cover over the majority of the site. The fires prescribed are expected to burn the duff and litter in small, discontinuous areas throughout the prescribed burn areas. Because of their small size (<100 square feet) these areas are not expected to degrade long-term site productivity. Because of the discontinuous pattern across the landscape, these areas are not expected to contribute sediment to nearby streams.

Soil biology and nutrient cycling: This treatment would result in a stand with a great deal of diversity and the forest floor would remain intact.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be erosion from the burning. Overall detrimental soil conditions would be about 1-4% from these treatments.

The effects of commercial harvest using a helicopter, followed by mechanical fuel treatment
These effects apply to about 48 acres (unit 48). The primary impact would be compaction from the mechanical fuel treatment.

Compaction: The equipment used for machine piling is typically lighter and has less ground-pressure than yarding equipment. Mitigation is included to limit the extent of this equipment, and to limit operations to dry conditions. Detrimental soil compaction does occur, but not everywhere the machine goes. In addition, parts of these areas designated as machine pile are too steep for equipment. In the areas piled, about 3-5% of the ground would experience detrimental soil compaction. This unit is suitable for mechanical fuel treatment.

Disturbance and erosion: Helicopter yarding has fewer resource impacts than other yarding systems. Excluding the landing, compaction and detrimental soil conditions generally do not occur (Alexander and Poff, 1985; Fredrickson and Harr, 1979).

Soil biology and nutrient cycling: This treatment would result in a stand with a great deal of diversity and the forest floor would remain intact.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be compaction from the machine piling. Total detrimental soil conditions would be about 3-5%.

Fuels Treatments
The effects of fuels/fire treatment as the only treatment
These effects apply to all or parts of the following stands 3010, 3011, 3012, 3013, 3019, 3034, 3038, 3039, 3045, 3134 (about 290 acres). This treatment consists of mechanical cutting and removal of submerchantable material (about 2 - 7 inches dbh) and any commercial-sized material located along skid trails. Cutting and removal would be done using cut-to-length equipment or similar equipment. This cutting and removal would only occur on ground flat enough for a CTL system, and in areas within 1,500 feet of roads[35]. The primary impact from these treatments is compaction which is limited to designated skid trails.

Standard practices, such as those for trail spacing and slope, apply to these stands as well.

Compaction: Most of these proposed units include soils with a high compaction potential when moist.

The impacts of this treatment are expected to be similar to a CTL treatment – where the treatment occurs. Unlike a typical CTL treatment, this treatment would not occur throughout the stands identified. These stands should generate sufficient slash, and the slash would be used to buffer the trails. With sufficient slash this activity area would experience about 9-10% detrimental compaction.

Erosion and Sedimentation: Cut-to-length machines that place a mat of slash before them do not bare the soil and subject it to erosion (personal observation). Erosion is rarely observed on CTL trails.

Soil biology and nutrient cycling: Duff and forest floor material would remain largely intact.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be from compaction. Overall detrimental soil conditions would be about 5-10% from these treatments.

The effects of underburning as the only treatment
This applies to about 2,890 acres (stands 3001600, 3001602, 3001607, 3001608, 3001609, 3001610, 3001611, 3001612, 3001617, 3001618, 3001726, 3001727, 3001728, 3001729, 3001730, 3001731, 3001732, 3001733, 3001734, 3001736, 3002063, 3002064, 3002065, 3002119, 3002120, 3002130, 3002131, 3002133, 3002134, 3002135, 3002137, 3002139, 3003002, 3003003, 3003006, 3003008, 3003009, 3003035, 3003044, 3003049, 3003050, 3003060, 3003061, 3003082, 3003094, 3003097, 3003099, 3003110, 3003112, 3003147, 3003155, 3003166, and 3003243). The primary impact would be erosion.

Erosion: Most of the areas proposed for underburning do not have a high erosion potential – they are too rocky. Stand 3044 (21 acres) is located on an escarpment between the upland till and Ruby Creek, in the vicinity of FR

[35] Carl Wright, personal communication, March 14, 2006.

2700050 The soil is Aits loam, 40-65% slopes. The erosion potential in this area is high because of the steep slopes and the lack of rock in the soil. Design criteria for these areas would maintain more soil cover and prevent excessive erosion.

The proposed underburning is low to moderate intensity. Most of the treatment areas are open-grown timber, hardwoods, and moderately dense brush. Low and medium intensity fires burn only part of the duff and litter – leaving adequate soil cover over the majority of the site. The fires prescribed are expected to burn the duff and litter in small, discontinuous areas throughout the prescribed burn areas. Because of their small size (<100 square feet) these areas are not expected to degrade long-term site productivity. Because of the discontinuous pattern across the landscape, these areas are not expected to contribute sediment to nearby streams.

Soil biology and nutrient cycling: The general effects of underburning on soil biology were described in a previous section. The prescribed fire proposed would be light intensity with small areas of medium intensity, and retaining unburned islands. This kind of burn would not have a long-term adverse impact on soil biota.

Total Detrimental Soil Conditions: The primary detrimental soil condition would be erosion from the burning. Overall detrimental soil conditions would be about 3-10% from these treatments.

Impacts to Sensitive soils: Rock outcrops-orthents are the only soils sensitive to fire which are found within the proposed burn areas. These areas are found along rocky ridges (**stands 3001732, 3003065, 3002119, 3002120**). Because of the rock, the vegetation is very sparse. With the light fuels and the design criteria to retain higher levels of duff and forest floor, there should be no problem with a low-intensity fire in these areas. Prescribed fire should not impact the productivity of these sites.

Effects of white pine pruning and precommercial thinning

Pruning and precommercial thinning do not disturb the ground; therefore these activities are not expected to impact long-term soil productivity.

Cumulative Effects

All units were visited. Existing detrimental soil conditions from past and on-going activities are very low. Every proposed timber harvest unit was examined for evidence of detrimental soil conditions from past and on-going activities. Most of the units have no existing detrimental soil conditions. The following units have existing detrimental soil conditions in excess of 10%, and the cumulative effects for these units would be described individually.

Unit 3. Existing detrimental soil conditions are about 14%. The most common detrimental soil condition is compaction due to livestock use, and homesteading activities. The proposed action is a single tree selection using a ground system, yard with tops attached, and underburn as needed. The configuration of the impacted areas is not amenable to re-using these areas for skidding[36]. Therefore, mitigation would be included to log this unit in the winter over snow to prevent additional compaction. Material in this unit may be landed on the adjacent road or in landings in the adjacent unit 2. At this location the mitigation is expected to be highly effective. With mitigation the total detrimental soil conditions after logging are expected remain about 14% after the proposed treatment.

Unit 44. Existing detrimental soil conditions are about 15%. The most common detrimental soil condition is compaction due to roads, an old gravel pit, and livestock use. The proposed action is a shelterwood using a CTL, masticate, and rip. The gravel pit could be used as a landing and another landing would probably be constructed – about ¼ acre in size. In addition to the skid trails, FR 2700006 would be ripped. All the CTL trails are expected to be ripped, and the livestock trail that follows the fence. Upon completion of the treatment, detrimental soil conditions (DSC) would decrease by 0-5% to about 10-15% DSC.

Unit 45. Existing detrimental soil conditions are about 10% of the unit. The most common detrimental soil condition is compaction due to FR 2700005 which bisects the unit. There are also detrimental conditions from livestock. The proposed action is a shelterwood using a CTL, masticate the fuels, and rip the trails. The ripping

[36] Livestock trails don't make a good CTL trail pattern.

would alleviate compaction on the created CTL trails, but not the pre-existing compaction. The material could be landed in the disturbed area between the road and the corral. Upon completion of the treatment, detrimental soil conditions would remain about the same level -- 10%.

Unit 64. Existing detrimental soil conditions are about 10% of the unit. The most common detrimental soil condition is compaction due to FR 2700056, 2700057, 3100433, and 3100445 all of which cross through the unit. There are also some detrimental conditions from livestock. The proposed action is a thinning/shelterwood with a ground system and mechanical fuel treatment. The stand contains abundant small cedar which would provide a good slash mat for a CTL system. The material could be landed along the roads, so no new landings would be constructed. About 22,000 linear feet of additional CTL trails is estimated. Since the CTL trails would generally be fairly short (500 feet or so) the impact would be lower that found on longer trails (estimate 15% DSC on the trails). The trails are assumed to be about 12 feet wide. This project would increase detrimental soil conditions by about 3% -- from 10% to 13%.

Unit 65. Existing detrimental soil conditions are about 11% of the unit. The most common detrimental soil condition is compaction due to FR 2700056 and 3100430, which bisect the unit. Livestock are a secondary source of detrimental soil conditions. The stand contains adequate small cedar and brush, which would provide an adequate slash mat for a CTL system. The material could be along the roads so no new landings would be constructed. About 22,000 linear feet of additional CTL trails is estimated. Some of these trails would be somewhat longer, and the operator would probably use a herringbone pattern to minimize the number of main trails (assume 17% DSC on the trails). The trails are estimated to be about 12 feet wide. The project would increase detrimental soil conditions by about 4% -- from 11% to 15%.

The cumulative effects of the increased spread on noxious weeds on soil productivity can only be described in general terms because of the large number of unknown variables. As described in the Noxious Weed report, weeds are likely to spread regardless of the alternative selected. Using a rainfall simulator in central Montana, Lacey and others (1989) found that sites dominated by knapweed have more runoff and sediment delivery than adjacent bunchgrass grassland sites. It is likely that areas dominated by knapweed, have higher erosion rates than similar areas dominated by grasses or covered by duff. It is not clear how noxious weeds compare to native forbs that naturally invade burned and disturbed sites. This project provides a mechanism, through the timber sale contract to seed disturbed areas. This seeding would reduce erosion and prevent the establishment of noxious weeds.

Forest Plan consistency

Each proposed unit was reviewed with regard to detrimental soil conditions. For treatments that may increase detrimental conditions (tractor, underburn, jackpot burn) detrimental soil conditions were estimated (ocular). About 80% were verified with transects.

In most cases, the existing detrimental soil conditions are low to very low. Standard practices such as skid trail spacing minimize the increase. Final detrimental soil conditions are expected to remain well below 20%.

Five units have existing detrimental soil conditions in excess of 10%. A more detailed analysis was done of these units. All units are expected to remain below 20% detrimental soil conditions.

Practices are included specifying skid trail spacing, CTL spacing, and slope limitations. Areas of high erosion and mass failure potential were identified and field verified[37]. Design criteria are included to maintain adequate levels of soil cover in areas with high erosion potential and to avoid treatments in unstable areas.

Standard practices address retention of soil organic matter. In areas especially sensitive to the loss of organic matter from prescribed fire, burn plans would be developed to retain higher levels of duff and forest floor.

[37] Documented in Soil Report, pages 10-11 and 16.

Scenery Management

Existing Condition

The Misery Lake analysis area is part of the Okanogan Highlands character type, which is described as generally rolling terrain of moderate slopes with broad rounded summits. Granite Peak, northwest of the analysis area, rises well above the general terrain dividing the area into several upland areas separated by a series of broad north-south river valleys. The vegetation is characterized either by large stands of continuous tree cover or stands broken by natural meadow openings. Generally, the vegetation is characterized by grand fir, Douglas-fir, larch, lodgepole and ponderosa pine. Fire plays an important role in creating the diverse vegetative patterns throughout the character type. Water forms are fairly prevalent in this character type, in the form of small lakes, marshes, potholes and ponds. Another prominent feature is the large north-south rivers that divide the character type, one of which is a long, narrow reservoir in the Pend Oreille valley. There are numerous small creeks and streams feeding into these major river courses.

The Misery Lake analysis area is primarily viewed as a backdrop to activities within the Pend Oreille Valley and as visitors travel along Washington State Highway 20 and Highway 31; County Roads 9325 (LeClerc) and 9345 (Sullivan Lake Road); and National Forest System road 1936 (Paupac). The analysis area is also viewed from Granite Peak accessed by Forest System trails (Trail No. 145 off of Trail No. 142).

Many residents living in the surrounding areas are descendants of the first settlers of the area and are likely to have strong values regarding the land. Local residents regard the area as an extended backyard. Visitors develop an attachment to places based on past experiences (ICBEMP[38] Vol. I), and families may visit the same area for a number of years and often many generations seek the same type of recreation experiences and activities. An appreciation for the value of natural scenery is expected to continue among residents and visitors to the area.

Forest Service roads access the interior of the area as well as several heavily used dispersed sites. There are no system trails or developed recreation facilities located on National Forest System Lands within the analysis area. Recreation use centers on dispersed activities such as camping, OHV use, hunting, and driving for pleasure (See Recreation Analysis).

The Bell to Boundary Transmission Line, operated by Bonneville Power Administration (BPA), runs north-south the full length of the analysis area. The permit for this transmission line allows for a 375-foot wide corridor through the existing vegetation. BPAs easement allows them to remove vegetation that could endanger the operation and maintenance of the transmission lines. Vegetation is manually cut and the resulting debris is lopped and scattered or chipped in the corridor.

Visual Quality Objectives were used in the Forest Plan to describe a desired level of scenic quality, and diversity of natural features, based on physical and sociological characteristics of a specific Management Area. The Visual Quality Objectives relating to proposed activities within the Misery Lake Planning Area are defined as follows:

- Partial Retention – Human activity may be evident, but must remain visually subordinate to the characteristic landscape.
- Modification – Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middleground or background.

Effects of Alternative A

In general, no immediate change would occur in the quality of the scenic resource. The quality of the Misery Lake analysis area as a scenic backdrop may not be sustainable. While no proposed activities would occur in this alternative, and consequently no immediate change in landscape appearance, in the long-term due to the high risk of stand-replacing wildfire, this appearance may not be sustainable, especially in the areas dominated by lodgepole pine.

[38] Interior Columbia Basin Ecosystem Management Project.

No actions would be taken to reduce the visual impact of the existing BPA transmission line corridor.

Effects of Alternative B

Road Construction Activities

In general, alternatives that propose road construction in visible zones would not preserve the natural appearing landscape character due to the un-natural linear feature imposed on those slopes. The contrasting elements of color and line would not be subordinate to the natural appearing characteristic landscape and therefore not meet Forest Plan direction for the area. The light colored soil and rock within the Misery Lake analysis area would be a concern.

In the Proposed Action the new road that would access units 22, 23, and 24 has potential to be seen briefly in middleground and foreground from State Highway 20, with a greater potential of being seen in middleground from County Route 9325 (LeClerc Road). The visual quality objective is Partial Retention; however, construction of the road would occur along the topographical/logging system break between the units. The intent is to locate the road away from the slope break, essentially moving it off of the steeper slopes to minimize any views of the road opening. The proposed selection harvest treatment would produce only a textural change to the vegetation, but there is still a potential for openings where the road would be visible from the Concern Level One and Two viewing locations. The proposed road location combined with the proposed harvest treatment and design requirements listed in Chapter 2 would meet Forest Plan standards.

The road proposed to access units 56 and 57 has the potential to be seen in background from the Paupac Road (1935000). The road construction, as proposed, does not have the frequency of views or the topographic concerns that would negatively affect the natural appearance of the characteristic landscape.

There are several proposed pit developments in the analysis area, and all fall within Management Area 6. All locations have the potential to be seen briefly in middleground and foreground from State Highway 20, with a greater potential of being seen in middleground from County Route 9325 (LeClerc Road). To meet the Partial Retention Visual Quality Objective for the area, any development would have to be topographically and/or vegetatively screened from the Concern Level One and Two viewing locations. While any pit development would have to be designed respective of visual concerns, the location identified in the Transportation Report as being within the SW ¼ NW ¼ Sec. 3 T35NR43E, and south of road 3100510, has the best potential for being topographically screened. All of the proposed pit locations would meet Forest Plan visual quality objectives.

Timber Harvest Activities

Proposed vegetation treatment along the BPA transmission line corridor would create openings adjacent to the corridor. These treatments should provide sufficient textural change within the stand to breakup the wall effect that has been perpetuated by the vegetation management within the easement.

The Proposed Action treats units within the foreground of Highway 20. Where skyline corridors are aligned at, or near 90 degrees to the line of sight, and stands are fairly uniform, there is a possible long-term effect due to the introduction of the unnatural vertical lines and color contrast from soil exposure and vegetation removal. This effect is especially visible in the winter months when snow creates a strong visible contrast to the adjacent vegetation. The unit of primary concern is Unit 22. Retaining a high stocking level within 300 feet of Highway 20 (part of the design criteria listed in Chapter 2) would meet Forest Plan standards for visual quality.

Other proposed commercial harvest units are located outside areas designated for Retention visual quality objective (VQO).

Helicopter logging would leave a pattern of textural changes without the linear contrast. Where harvest openings are placed in such a way as to break-up the contrasting line between private and Forest Service lands, the long-term effect would be positive.

The following activities/treatments would meet their respective Partial Retention and Modification VQOs (as seen from critical viewpoints) in the proposed action alternative: Selection Harvest and Selection

Harvest/Shelterwood. These activities retain the mature forest canopy as seen in middleground or background with only textural changes in the canopy, thus allowing them to meet respective VQOs.

The following activities remove more of the forest canopy than those described above, thus creating greater textural changes, but usually not exposing ground surface to viewers due to retained understories and some over-story elements: Commercial Thin, Commercial Thin/shelterwood, and Shelterwood. Examples of factors that aid in meeting VQOs that are site-specific include: topographic screening and vegetative screening. These activities would meet their respective VQOs of Partial Retention and Modification when designed and mitigated as suggested.

Timber harvest activities would meet Forest Plan standards for visual quality objectives.

Fire Management Activities

The Visual Quality Objectives were developed for forest management activities that are defined as human activity imposed on a landscape for the purpose of harvesting, traversing, transporting, or replenishing natural resources. They are not well suited to the temporary effects of under-burning. In addition, fire is a natural process regardless of whether ignition is by human intervention or natural causes. The goal of the Visual Management System has been to strive to maintain a natural-appearing landscape. Since it is a natural occurrence, fire, even prescribed under-burning in moderation, is consistent with a natural-appearing landscape. On the other hand, a heavily burned-over landscape from a stand-replacing wildfire is generally considered aesthetically unattractive even though it may be natural appearing. A moderate use of jackpot or under-burning proposed by these alternatives may help to diminish the risk of wildfire and the resulting negative visual impacts.

Post stand treatment, through the use of jackpot or under-burning, may be necessary to reduce activity debris and the risk of wildfire. While, due to the length of contiguous activity, there would be short-term noticeable changes, the long-term appearance would be of a healthier, more open, and natural appearing landscape.

Prescribed Fire areas would meet VQOs as over-story trees would screen middleground views of blackened ground surfaces; green-up would occur the following spring.

Cumulative Effects

Treatment of the vegetation within the Misery Lake analysis area, at a broad scale, whether through timber harvest or noncommercial means, would serve to perpetuate the desirable attributes of the existing landscape character. From a scenery standpoint, activities that treat vegetation at the landscape scale, without the introduction of long-term negative visual elements, would meet the objectives of the Forest Plan. With careful design and mitigation, the necessary temporary roads, skyline corridors, and harvest debris would not take away from the positive attributes of the landscape character of National Forest Lands.

The activities visible on private land, with the frequent use of even-age timber harvesting techniques, would continue to draw the attention of travelers in the area.

Since a large portion of the transmission line corridor is located within the landscape viewed from State Highway 20, County Route 9325, and the Pend Oreille River, the corridor would remain as a negative visual element and continue to reduce the scenic integrity of the area. Alternative B would treat stands along the BPA transmission line corridor and begin to breakup the stark visual contrast between that corridor and the vegetated slopes.

Recreation

Existing Condition

Recreational uses in the Misery Lake project area include camping, picnicking, OHV (off-highway vehicle) riding, hunting, fishing, horseback riding, hiking, driving for pleasure, wildlife viewing, berry picking, mushroom picking, and firewood cutting. The most popular time of year for these activities runs from Memorial Day weekend to Labor Day weekend. In addition, winter recreational uses include snowmobile riding and snowshoeing.

There are 26 dispersed camping sites scattered throughout the Misery Lake project area. Dispersed campsites are sites along roads, trails, rivers, streams, and lakes that are attractive for overnight stays. They frequently have a

fire ring, are located in flat or nearly flat areas, have a core compacted area due to frequent use, and have some defined or known access route. Amount of use of the dispersed campsites in the project area varies from occasional to heavy use. These sites provide staging areas for some of the other recreational opportunities already mentioned.

Undesignated trails (< 50 inches wide) and roads (> 50 inches wide) occur primarily in the southern half of the project area, south of County Rd. 2489 (Ruby Creek Rd). These roads and trails are used for many of the recreational opportunities already mentioned, especially OHV riding and horseback riding. Approximately 17 miles of unauthorized roads and 5 miles of undesignated trails exist in the project area. In addition, there is a sand deposit (see Figure 3 below) located near the intersection of FS roads 2700003 and 2700005 that receives OHV use.

Figure 3. Picture of sand deposit near intersection of FS roads 2700003 and 2700005. Forest Service, county, and state roads provide access to recreational opportunities within the Misery Lake project area. There are about 30 miles of Forest Service road open for public use. In addition, there are about 7 miles of county road and about 8 miles of state highway located in the project area. Also, Forest Service Roads 2700423 and 2700003 are designated for OHV riding.

Effects of Alternative A
Alternative A would result in no change in the types of recreation opportunities available in the project area. However, the likelihood of wildfire would increase with time if fuels are not removed. Wildfire would likely displace recreationists for a period of time.

Effects of Alternative B
Dispersed Camping - Proposed thinning, harvest, underburning, and fuel treatments could reduce access or cause disturbance, in terms of smoke, dust, and noise, of up to 26 known dispersed campsites that are located within the project area. The duration of this effect would only last for the duration of implementation, which would likely be five years. It is unlikely that all 26 sites would be affected at the same time because treatments in all proposed units would not occur simultaneously.

Section 4-36 of the Forest Plan (US Forest Service, 1988) requires that the immediate foreground (approximately 500 ft) around significant dispersed recreation sites be managed to meet the retention visual quality objective, meaning that management activities should not be visually evident. Two dispersed sites within the analysis area were evaluated and determined to be high-use dispersed sites. One site is located just north of the junction of FR 2700-002 and County road 2489 (Ruby Creek Road) and is used seasonally by the US Air Force. This is an established site for the USAF and would be protected during operations. The other location located in the southwest ¼, section 15, T30N, R45E (immediately south of unit 44 – see appendix B for unit locations) is an established dispersed camping area with a user-installed toilet and camping area, and it is adjacent to user-created OHV trails. This site would also be protected during operations. Specific project design criteria for each site is listed in Chapter 2.

Recreational Use of Roads and Trails - Recreationists who drive in this area to view scenery may be displaced during implementation of the project. However, implementation of treatment units would be spaced out over time, so roads would be affected at different times. Additionally, the treatments should eventually enhance

scenery in the analysis area, since the treatments are designed to move the treatment areas to a more open, park-like setting.

Recreationists who use the roads and the undesignated roads and trails for recreational purposes, such as horseback riding, OHV riding, and hiking, in the area may be displaced during implementation of the project. Again, since treatments would not occur simultaneously, it's not likely that all roads and trails would be affected at the same time. One concern is the possibility of additional undesignated roads and trails developing in the shelterwood treatment areas. An average of 20 trees per acre would remain in these areas after treatments have occurred. The opening up of these areas could be very inviting to recreationists on OHVs.

The relocation of part of FS Rd. 2700005 would make that road safer for use, as it eliminates a precarious section of the road.

Hunting - Hunters may be displaced during implementation, due to increased activity and noise. This effect would only last the duration of the project.

Snowmobiles - Although most of the analysis area is winter range, some snowmobile use does occur, especially along the power line in the southern half of the analysis area. While most treatments would occur during the summer, some activity would take place during the winter. Snowmobilers could be displaced as a result of this winter activity.

Solitude - It is likely that solitude would be affected by the increase in noise and activity in the analysis area. This reduction in solitude should only last as long as the duration of activity. New road construction proposed in the analysis area could further reduce solitude for recreationists who wish to find places where they cannot see roads or hear vehicles. However, all new roads (except the relocated portion of FS Road 2700005) would be closed after the project is completed, so these effects would not be long-term.

Cumulative Effects
Similar treatments are currently being conducted in the Browns Lake area to the north of the Misery Lake project area and in the Gardiner/Tacoma Creek area to the south. Access to Browns Lake is poor, so the area is used lightly for recreation. The Gardiner/Tacoma Creek area receives extensive recreational use in the forms of dispersed camping, scenery viewing, motorized and nonmotorized trail usage, hunting, and fishing. It is likely that some recreationists would be displaced from all three project areas. However, design criteria that restrict treatments during high-use weekends would help alleviate that displacement. In the long-term, these treatments would be beneficial to recreation, as they would reduce the threat of severe wildland fires and create more open, park-like conditions.

Range Management

Existing Condition
At this time Ruby Creek Cattle and Horse allotment is active. Since 1976 the allotment has had one permit holder. This permittee grazes 126 cow/calf pairs on the allotment each year. Grazing seasons last approximately four months of the year. Depending on vegetation and other conditions the grazing season extends from around June 1st through September 30th.

Forage
The dominant plant association in the allotment is *Tsuga heterophylla (*TSHE*)/Clintonia uniflora (*CLUN*)/Vaccinium membranaceum (*VAME*)* (western hemlock/queencup beadlily/ big huckleberry). This plant association normally occurs on upland habitats, but it has been documented near or along streams in the eastern limits of the TSHE species. Since this area was heavily burned within the last century the TSHE/CLUN/VAME stands in both allotments can be considered early seral. Often these stands contain a variety of seral tree species and have diverse understory vegetation. Early seral stages of this association can provide considerable amounts of forage for both livestock and wildlife species. Cattle tend to avoid the more mature stands of this habitat type due to lack of available forage.

Most of the available forage in Ruby Creek is located in natural meadows and old homestead clearings. These include areas such as Squirrel Meadows, Rufus Meadows, Henry Brown Meadow, and so on. Additional forage is located along riparian corridors such as North Fork Ruby Creek. Forage is also present as transitory range underneath powerlines and in timber harvest units. Primary range for cattle in this allotment is along the powerline corridor, in Squirrel and Henry Brown Meadows, small areas along Ruby Creek near the county road, Rufus Meadows area, and South Fork Lost Creek. Secondary range is along a majority of North Fork Ruby Creek, along the edges of the powerlines, Ruby Creek, and little Ruby Creek.

Primary forage for cattle consists mainly of perennial grasses. The dominant forage species are *Poa pratensis* (Kentucky bluegrass) and *Agrostis gigantean* (Redtop). Other palatable grasses include *Poa secunda* (Sandberg bluegrass), *Festuca idahoensis* (Idaho fescue) and *Dactylis glomerata* (Orchardgrass) among others. Upon utilization of primary forage cattle begin to graze on secondary forage such as *Taraxacum officinale* (common dandelion) and other forbs, sedges, and woody plants. Native grass species such as fescues, bunchgrasses, and bromes are not plentiful but are being returned to the system through seeding of disturbed areas such as skid trails, roadsides, and recreation sites.

Quality and vigor of forage in the allotment has been diminished by the presence of noxious weeds. All of the meadows and roadsides have some level of noxious weed infestation, which is steadily reducing forage in those areas. The areas impacted the most have been the powerline corridor, roadsides and other travel corridors, as well as areas that have been disturbed by OHV use and camping. Chief invaders include *Hieracium aurantiacum* (orange hawkweed), *Hieracium pratense* (yellow hawkweed), *Centaurea ssp*. (knapweeds). Other notable species include *Linaria genistifolia L. dalmatica* (dalmatian toadflax), *Potentilla recta* (sulfur cinquefoil), *Tanacetum vulgare* (common tansy), Cynoglossum officinale (houndstongue), *Hypericum perforatum* (St. Johnswort) and various thistles.

Loss of transitory forage has been somewhat offset in the last 15 years in the Ruby Creek allotment because past timber sales used mostly even-aged silvicultural harvest systems. This, combined with grass seeding on the skid trails and landings, has created several large blocks of useable forage. However, management trends are predicted to decrease the number and size of timber sales that use even-age silvicultural systems in the future. This would decrease the amount of transitory forage over time as succession causes canopies to close, thus excluding grasses and forbs in the past timber sale units.

Riparian Condition

Generally, the allotment has not exceeded forest plan standards for utilization, but there are localized areas that have been overgrazed in some years, particularly some meadows that are compacted from past logging and homesteading as well as grazing. The riparian areas overall are in good condition, but there are a few localized areas where stream banks have been trampled and eroded as cattle cross back and forth. The areas that are the biggest problem are the riparian areas that also have recreation and air force use such as the corral area on the 2700003 road; and some “hot spots” in the North Fork of Ruby Creek.

Improvements and Structures

There are four cattle guards and associated drift fences in the allotment. The cattle guards are cleaned by either the Forest Service or the county, depending on which road they are on, and the permittee maintains the drift fences. There is one water development in the allotment, which is a spring-fed trough under the powerline just uphill from the first Ruby Creek cattle guard.

Effects of Alternative A

The “no action” alternative would result in no timber harvest, precommercial thinning, or prescribed fire activities within the Ruby Creek grazing allotment.

This alternative has a greater potential to adversely affect range management because forage production would decrease as tree densities continue to increase. This is true in areas of past timber harvest, which at this time are still providing transitory range benefits of forage production. As the amount of uplands that support grazing decreases due to the encroachment of trees, riparian area impacts could likely increase.

Under this alternative range improvements would be at greater risk of having wildfire damage which could destroy them. If a wildfire were to occur within the project area, there would likely be little done to protect range improvements and the improvements would have to be reconstructed using program funding.

Effects of Alternative B

Transitory rangelands

Alternative B would result in a more open timber stand where there is likely to be a greater amount of herbaceous vegetation in the understory (Gillen, Krueger, and Miller, 1984). Converting dense forested areas to more open stands is beneficial to range management and forage production by creating transitory rangelands that provide mid-term grazing land which provides forage to livestock and wildlife. Forested sites have a high potential for producing forage following logging because moisture availability is relatively high and competition from previously established species is less (Miller and Krueger, 1976). Transitory rangelands for the Misery Lake analysis area would be created primarily by commercial timber harvest and fuel treatments and road construction/reconstruction combined with surface fuel treatments. Reseeding of logged areas can create a valuable temporary forage supply and can hold and rebuild the soil for future timber crops (Wilson, 1960). Noncommercial timber and fuel treatments, such as precommercial thinning, would not likely create large enough openings to generate forage and produce transitory rangelands. Most of the created transitory rangeland would be in the uplands, therefore they would act to attract livestock away from riparian areas by providing foraging areas in the uplands.

Alternative B of the Misery Lake project would create an approximate 2,815 acres of transitory rangeland in the Ruby Creek Allotment. The transitory rangeland would be created in the southeast portion of the Ruby Creek allotment. The transitory rangelands that would be created by the Misery Lake project would be beneficial to livestock management by providing increased forage production.

Riparian areas

Alternative B is not anticipated to have an increase in fecal coliform levels in Ruby Creek. Monitoring results show that fecal coliform colony numbers are at acceptable levels for the majority of the grazing season. The only recent spikes in fecal coliform counts seem to occur in the late spring/early summer before livestock have begun to graze the allotment. Alternative B would result in few probable new livestock access points to Ruby Creek, therefore fecal coliform levels are not expected to increase. Research has shown that cattle grazing in moderately stocked pastures have no influence on water coliform counts (Buckhouse and Gifford, 1976).

Forage

Health and productivity of herbaceous vegetation is expected to increase following prescribed fire in the project areas because there will be less competition for available moisture if shrubs and small tree are removed from sites. Increased forage and foraging areas for livestock would result from the areas proposed for a combination of timber and fuels treatments defined in this alternative

Range improvements

Livestock management is accomplished in part by range improvement projects that exist within the Ruby Creek grazing allotment. These range improvement projects include such items as fences, water developments, corrals, and exclosures. These projects are critical for the implementation of sound livestock management, encourage and support livestock grazing in acceptable areas, keep livestock from leaving the allotment and provide for resource protection. With the proposed project design elements, it is expected there would be no impact to range improvements.

Natural barriers

Implementation of alternative B may result in a need for additional fencing due to the removal of natural livestock barriers that act as allotment and pasture boundaries in the vicinity of units 15, 16, 17, 18, 21, 24, 53, and 58. The combination of harvest treatments and burning has the potential to affect approximately 5 miles of natural barriers. Any barriers lost or removed during project implementation would be replaced per the design requirements listed in Chapter 2.

Roads
Gated road closures that would allow administrative access would be beneficial for livestock management, specifically, the specified road that is proposed to be constructed off of the Ruby Creek road and access units 6 and 7. Allowing the permittee administrative access would allow them to better manage their livestock and attempt to keep them on the allotment and off of State Route 20.

The proposed road that would begin at and continue through unit 25 would be constructed through an existing livestock management fence that acts as the allotment boundary. This road would need to have a six-rail metal livestock gate installed and tied into the existing fencing so that the fence would continue to function as a barrier to livestock movement. Installation of this type of gate in the location of the fence would prevent cattle from exiting the allotment.

Noxious weeds
Some noxious weeds are spread by livestock grazing on Forest Service lands. Houndstongue seed can become attached to cattle and wildlife hair only to later fall off and cause new infestations (De Clerck-Floate, 1997). The project is likely to result in there being no increase in noxious weed populations within the project area by implementing the noxious weed mitigation measures. Therefore, livestock would likely not impact the spread of noxious weed seeds following project implementation.

Cumulative effects

Past timber harvest activities have resulted in a positive effect on the forage base for the Ruby Creek allotment. Timber harvest created openings in the forest which provided temporary additional forage for livestock by way of creating transitory rangelands. When transitory rangeland is created and available, it reduces the level of grazing pressure on other grazing lands within the allotment. Transitional rangelands also provide an abundance of forage for livestock which produces heavier calves for the producers and higher economic gains when their calves are sold at market.

Timber harvest on private land adjacent to or within the allotment in T. 35 N., R. 43 E., sections 3, 11, 13, and T. 36 N., R. 43 E., sections 27, 28 and 29 may contribute some forage within the allotment, but may also breach some natural barriers. Some of this logging has already taken place and is encouraging cattle to leave the allotment in the north end and in the vicinity of Squirrel meadow. This, combined with timber harvest in this project, puts additional pressure on the permittees to maintain such structures.

In the past, wildfire has played a major role in the current landscape of the Ruby Creek grazing allotment. Potential wildfires in the Misery Lake project area could impact livestock grazing in the short-term by displacing livestock, but would provide long-term benefits such as transitory rangelands and increased forage productivity. The vegetation and fuel treatments proposed by the Misery Lake project would likely produce the same positive benefits of transitory rangeland, but without the short-term negative impacts to livestock management since prescribed fire would occur outside of the grazing season.

Alternative B should improve transitory range and make permit management less complicated. As a result of the action alternatives, overall riparian health should improve because of the creation of transitory rangeland in the uplands of the allotments. Alternative B would also allow the affected livestock permittees to continue grazing at current levels with greater economic returns. Federal lands are very important in the production of red meat to supply public demand (Holechek, 1981). This in turn would help maintain the local grazing industry, the ranching lifestyle, and the local economy.

The activities proposed in alternative B combined with past, ongoing, and reasonably foreseeable future actions would not cumulatively negatively affect range management within the affected Forest Service grazing allotments.

Summary
Generally the Misery Lake project would be beneficial to range management by producing a more open timber stand and removing shrubs and other fuels from the understory. These treatments would create an approximate

additional 2,815 acres of transitional rangelands that would be able to provide quality forage to permitted livestock for up to 15 years.

If implemented, alternative B would create transitional rangeland that would be available for livestock grazing in upland sites. By providing grazing opportunities in uplands, livestock would be less likely to loaf in riparian areas.

By implementing alternative B, grazing lands would be at a reduced risk of damage caused by stand-replacing wildfire, which could create hardships for grazing permittees and cause widespread damage to grazing allotments and range improvements.

Heritage Resources

Existing Condition

There are twenty-five identified historic properties within the proposed analysis area. Five of the twenty-five historic properties are located within or near identified planning units, and have the potential to be affected. Past management practices have not evaluated these properties for eligibility to the National Register of Historic Places (NRHP). Historic properties that are unevaluated are managed as if eligible, and mitigations for these properties would follow management prescriptions as specified in table 13. Currently the Heritage Program management attempts to relocate sites, monitor the sites for damage/deterioration, evaluate the sites for NRHP eligibility, and preserve/protect the sites.

Management Class Recommendations

A NRHP determination of eligibility is prescribed by the NHPA implementing regulations at 36CFR800 as the method for designing management recommendations for historic properties located on National Forest System lands. Evaluations of eligibility are performed for each property within the project boundary, when practical. Following this, management prescriptions are provided for project analysis. The following list of management prescriptions was developed for historic properties on National Forest System lands. These prescriptions are based on National Register eligibility determinations for historic properties.

Table 13. Management Class Prescriptions.

Management Class	Prescription
1	Evaluated as Not Eligible. No further need to actively manage.
2	Not Evaluated. Property must be protected and preserved as if eligible. Protect historic property through avoidance.
3	Evaluated as Eligible to the National Register. Project would have No Effect on property. Property must be protected and preserved as defined by Regulation. Protect historic property through avoidance.
4	Evaluated as Eligible. Project would have an Adverse Effect on property. Property must be protected and preserved as defined by Regulation. Protect historic property through avoidance.

Effects of Alternative A

There would be no change from the current condition. Heritage sites would continue to gradually deteriorate over time, subject primarily to natural forces (i.e. weather conditions, unexpected wildfire, etc.). Natural forces could destroy or significantly damage standing or downed historical structures, affecting potential National Register eligibility characteristics of these properties.

Effects of Alternative B

Five heritage sites (Management Class 2) have the potential to be impacted under alternative B. Project activities have the potential to damage or destroy these sites directly by heavy machinery, falling trees, road building, fuels treatments, etc., or indirectly as a result of discovery through increased access to each site. The Forest Archaeologist or qualified Heritage Program personnel would identify sites on the ground and would coordinate with appropriate project personnel to provide location information to presale, roads, and fuels treatment crews.

Management Class 2 sites would be protected and preserved as if they were eligible to the National Register of Historic Places (NRHP). Project activities are designed to avoid direct impacts to the sites (e.g. delete or buffer entire unit or a sufficient amount of the unit to avoid impacts to the site). With these design measures, it is expected that there will be no adverse impacts to heritage resources.

Historic properties within the planning area will experience minimal cumulative effects from this project. Effects may include potential damage to, or loss of, sites due to increased accessibility to properties due to thinning of trees/shrubs near the site or the re-opening of forest service roads. Proper buffering and maintenance of confidentiality of historic properties will effectively prevent these possible impacts. The Forest Archaeologist or qualified Heritage Program representative will provide guidance on appropriate buffering distance to protect the site locations. The State Historic Preservation Office (SHPO) concurs with these actions.

Cumulative Effects
There are no cumulative effects of combining this project with activities on adjacent lands. Future activities associated with alternative B within the analysis area would have no foreseeable cumulative effects on the historic properties.

The Misery Lake project with the design criteria provided meets the Forest Plan Standards and Guidelines for Cultural Resources item 2 page 4-37 and Federal regulations concerning Heritage Properties (National Historic Preservation Act and its implementing regulations at 36CFR800).

Special Uses and Easements

There are currently five land use authorizations (two special use permits, one land use grant instrument, and two easements) that are either within the Misery Lake analysis area or rely on road systems that pass through the analysis area for access and management. One of the special use permits is for the US Air Force Survival School, which is discussed below. There are no adverse impacts (direct, indirect, or cumulative) anticipated with regard to improvements authorized under special use permits, easements, or land use grant instruments within the project area.

US Air Force Survival School
The USAF operates on the Colville National Forest under the terms and conditions of a Special Use Permit issued to the 336th Training Group, Air Education Training Command (Survival School) located at Fairchild Air Force Base.

The USAF no longer has a permit to occupy the Little Pend Oreille National Wildlife Refuge (LPO), as outlined under the guidelines set by the Final Comprehensive Conservation Plan and Environmental Impact Statement, April 2000. The plan required the USAF to be phased out of the refuge by 2005. This connected action affects the Misery Lake analysis area as it relates to USAF use of the Tacoma Training Area. The loss of the LPO and the associated loss of the hunting closure that protected the USAF would cause more Survival School operations within the Parker Lake hunting closure, within a portion of the Misery Lake analysis area. The phase out would require the USAF to occupy the Parker Lake Closure with more intensive use from September until the end of May, due to normal hunting seasons and the inability of the USAF to move operations during periods of snow and spring thaws. All Forest Service activities within the Parker Lake Closure would need close coordination with the Survival School's operations. This is especially necessary between September and May when the Parker Lake Closure is occupied. The Parker Lake Closure is located in the southern portion of the Misery Lake analysis area, south of the Ruby Creek road (2700) and west of the BPA power lines.

Existing Condition
The US Air Force Survival School conducts extensive training in survival skills and recovery techniques within the Misery Lake analysis area. This training has occurred since 1965 under agreements and Special Use Permits (SUP). The current SUP identifies locations and practices and methods of training that are consistent with the Standards and Guidelines of the Colville National Forest Land and Resource Management Plan (LRMP).

The Survival Evasion Resistance and Escape (SERE) training program is designed for approximately 3,700 Air Force personnel annually, with duties or operations that involve a high-risk of capture.

Two of the training programs taught at the Survival School involve training operations on lands administered by the Colville National Forest. One program is the basic survival course (S-V80-A) that is taught to all Air Force aircrew members. Typically, a class of 75-90, S-V80-A students are in training on or near the Colville National Forest each week of the year. The Instructor training course (S-V81-A) is a six-month long course that prepares 30–50 instructors to teach the S-V80-A course. Two S-V81-A classes are taught each year, for a combined eight to ten training "phases" on the Colville National Forest.

Parker Lake Hunting Closure

The Washington State Department of Fish and Wildlife granted the Air Force a hunting closure for the protection of the survival school personnel. The Parker Lake closure is granted for the entire year and is located on the Newport Ranger District. The closure is east of the Tacoma Creek road (2389), south of the Ruby Creek road (2489) and west of the BPA power line corridor. The land area in the Parker Lake closure has been heavily utilized for Survival School training since the 1960's. As a result of this prolonged use and the forest management activities that have occurred; some areas in the Parker Lake closure are currently unsuitable for training, due to lack of resources. Other areas are too thick with vegetation and have been under utilized in the closure area. Other areas of the Parker Lake closure have no road access for training.

Training Area Selection

A Nine-Year Plan is the School's guidance for training area use. Each year, the Training Area Management Review Board (TAMRB) evaluates the projected resources, conflicts, and costs of training and recommends an updated plan to the School Commander. The TAMRB board fine-tunes the plan and a final nine-year implementation plan is developed.

The selection of instructor camps for winter occurs in the late spring before the next winter period of use. The specific locations are requested by the Survival School and jointly reviewed with the Colville National Forest. Approval is given and setup of winter shelter sites usually occurs in September or early October of each year.

Activities

The instructor camps typically consist of one large prefabricated shelter, a latrine or portable toilet, ten to twelve instructors and three vehicles parked adjacent to the road system. During much of the winter training period, the effects of training are minor. During the seasonal transition from winter to spring, the effects of vehicle use during training become more apparent. Vehicles parked or otherwise left off road during below freezing evenings can create ruts and puddles following thawing during the day. Rutting would occur when vehicles are used. Frequently, the Survival School can schedule activities to avoid use of camps that are susceptible to soil damage. The other option is to use roaded areas that the School has placed crushed rock on or a combination of both. The School must use the roads and instructor camp areas during the spring break up period. They also use tracked vehicles as much as possible during spring break up. The use of tracked vehicles is increasing.

Direct, Indirect, and Cumulative Effects

Alternative A – The fuel build up in the Misery Lake analysis area creates the possibility of wildfire and losing the vital resources in the Survival School training area including the possible loss of the Ruby Command post, located just outside the analysis area boundary. The Air Force would continue to fix road problems not created by their use. No benefits would be derived on the timber sale cooperative use of gravel pits and rock sources. Vegetation would continue to grow and create thicker stands, where students can't travel very well on foot. Small game may decline due to a lack of forage production.

Alternative B –

Burning - In general the short-term (1-5 years) would be a negative effect due to some removal of cover when trees are killed. The benefits would come with the long-term (5-10 years) as new regeneration becomes established and develops additional cover and small animal habitat. This project covers a small portion of the larger permit area, but includes the majority of the Parker Lake closure area which is used by the US Air Force during the hunting and winter seasons. Implementation of this project would improve quality of the area over the long-term for winter training.

Road Gating/Berming - In general, both the short- term and long-term effect is positive from gating roads that allow Air Force use.

Logging and timber sale road maintenance – The project area includes the majority of the Parker Lake closure area which is used by the US Air Force during the hunting and winter seasons. In general more acres harvested leads to more potential for winter logging and timber sale road maintenance. Due to safety concerns about using the area for training during timber sale operations, harvest and road maintenance activities have a short-term, negative effect. This is due to the amount of the project area that is located within the Parker Lake closure. The long-term period would potentially be a positive effect due to improved vegetative and wildlife habitat condition.

Roads (gravel pits and rock sources) - In general more miles of roadwork would increase the potential for gravel pits and rock sources to be developed. The effect is positive in the short-term and the long-term for the availability of rock for the Air Force. Delays and road shut downs would be a negative effect in the short-term.

Transportation

Washington State Highway 20 provides the main access to the eastern perimeter of the analysis area. Pend Oreille County Road 2489 (Ruby Creek) traverses the center portion of the analysis area and numerous local Forest Service roads provide additional access into the central and southern half. The northern third of the analysis area is generally lacking access by authorized system roads except for along the northwestern perimeter which is generally bordered by 2700423.

Existing Condition

Based on a query of the Infra-Travel Routes database of the mapped transportation layer using Arc View on 6/29/04, there are approximately 48.5 miles of *authorized roads* in the Misery Lake analysis area. An approximate breakdown of these roads by jurisdiction is as follows:

Jurisdiction	Length(mi.)	% of total
State	7.8	16.1%
County	7.4	15.3%
Private	2.8	5.8%
USFS	30.5	62.9%

Not included in the above table are the approximately 16.9 miles of *unauthorized roads* that were identified and mapped during the Lost Granite Squirrel Road Analysis process. The roads in this category were unplanned and may be the result of past resource extraction, homesteading, or they may be user created roads.

Effects

For alternative A, no road construction, reconstruction, or maintenance beyond what is planned for other projects or standard Forest maintenance work would occur.

Alternative B proposes approximately 4.8 miles of new road construction, approximately 20.8 miles of reconstruction (classified as either light or medium reconstruction), and approximately 0.5 miles of temporary road construction. Approximately 8 miles are proposed for decommissioning (removed from the Forest transportation system by either physical closure or obliteration).

Table 14. Road Construction, Temporary Road Construction, Reconstruction, and Decommissioning.

Alternative	Miles of New Construction.	Miles of Temporary Road Construction	Miles of Reconstruction	Miles Proposed for Decommission	Net Change in Open Road Miles
A	0.0	0.0	0.0	0.0	0.0
B	4.8	0.5	20.8	8.0	-3.2

For alternative B newly constructed system roads would be closed with either a gate or earthen berm. All presently closed roads used with this project would be administratively closed to the public while the project is active. Once project activities are complete, closed road entrances would be reclaimed and obliterated.

Economics

Benefits

There are several benefits that are accrued from this project. One benefit displayed in this analysis is stumpage received as a result of harvest of timber volume from proposed alternatives. This number is the advertised price of the sale. It is based on the value of the wood when it is delivered to a mill that utilizes this wood minus the logging costs and other required sale costs. This is a rather conservative number as most sales on the Newport/Sullivan Lake Ranger Districts are bid up considerably above the advertised rate. This value is in dollars per hundred cubic feet[39] ($/CCF).

Another major benefit assumed by this project is the risk reduction from stand-replacing wildfire by doing fuel reduction activities. The benefits from this activity are hard to measure as they involve non-market values. This analysis used the values published in "RTI Fact Sheet #28 – Investments in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits". The benefits included in the monetary value used in the analysis include: fire-fighting costs avoided, fatalities avoided, facility losses avoided, timber losses avoided, regeneration and rehabilitation costs avoided, community value of fire risk reduction, increased water yield, and regional economic benefits. This analysis stayed somewhat conservative and assumed that all of the acres in the project area are at moderate risk instead of high risk. The assumption for moderate risk is that there is an equal probability that all acres would burn sometime in 60 years and that the average burn time would be 30 years. In the Misery Lake analysis, this benefit was only applied to acres receiving some sort of fuels or silvicultural treatment. The monetary amount input into the program is a future fire cost which is foregone due to planned treatments and is discounted to the present.

There are other benefits that result from timber harvest, but are difficult or impossible to value in terms of dollars. Some of these benefits might include: moving stands toward late and old structure sooner, improved wildlife habitat, and improving visual appearance.

Costs

The costs used in this analysis include estimated costs for specific project design requirements, road reconstruction, logging, natural and activity related fuel treatment, road maintenance, road obliteration, and some sale area improvement activities.

The cost of planning is not included in this analysis. The planning costs were considered at the time of project initiation to determine if the project was feasible. However, by the time the environmental assessment is finalized, most of the planning costs would already have been incurred and would not vary by alternative.

Logging contributes the most amount of the cost to the total alternative cost. The helicopter logging cost is the most expensive of the logging systems analyzed. Alternative B proposes commercial timber harvest as a treatment activity. This alternative has three logging system types, which are mechanical ground-based, skyline, and helicopter. Logging costs were determined by using the LogCost80 spreadsheet and the recently sold Conger Timber Sale.

In alternative A, No Action, none of the fuel or vegetation treatments would occur. There would be no reduction in fire risk level, so there is a higher potential for incurring costs related to fighting wildfires under this alternative.

Table 15 below displays a summary of Present Net Value Benefits and Costs for each alternative of the timber sale portion of the project. A summary of Present Net Value Benefits and Costs for each alternative for the whole project can be found in Table 16.

[39] To convert hundred cubic feet (CCF) volume to thousand board feet (MBF), multiply the CCF quantity by 0.52.

Table 15. Present Net Value (PNV) Benefits and Costs by Alternative For Timber Sale Portion (commercial treatments only) of Misery Lake Project.

Alternative	Acres	Volume -- CCF	Discounted Benefit	Discounted Costs	PNV ($)
A	0	0	0	0	0
B	2,815	45,486	$1,999,028	($1,870,476)	$128,552

Alternative B uses commercial timber harvest to meet the objectives of the project. The sale-as-a-whole present net value is positive number. A unit-by-unit analysis would show that some of the units are positive and some are negative. The units which require helicopter yarding are generally the units that are negative due to the high cost of this system. Since the majority of the sale would use a ground based system, which is generally the least costly, the cost is weighted towards this less costly system.

Table 16 displays a summary of costs and benefits with commercial and non-commercial activities combined. Costs listed under alternative A are associated with expenses incurred if a wildfire ignited the untreated area (which is related to the higher fire risk level).

Alternative B is economically viable based on the PNV values shown in Table 16. This analysis includes the costs and benefits of fuel treatments outside of the timber sale units. If this project or a portion of the project is implemented as a stewardship project, the receipts from selling forest products would offset the service work required to reduce fuels.

Table 16. Present Net Value Benefits and Costs by Alternative For Entire Misery Lake Project (commercial and noncommercial treatments combined)

Alternative	Benefits	Costs	PNV ($)
A	0	($3,952,844)	($3,952,844)
B	$2,576,558	($2,326,732)	$249,826

The additional benefit from the noncommercial fuel treatments is the risk reduction from a future wildfire and its associated costs. The net benefit is derived from the moderate risk column in Table 1 in the RTI Fact Sheet #28 “Investments in Fuel Removals to Avoid Forest Fires Result in Substantial Benefits” by Mason, Lipke, and Zobrist. Conversely, this could be a cost for alternative A where no treatments would occur to reduce wildfire risk.

Forest-wide goals, objectives, and standards for economics are not specifically addressed in the Forest Plan. This issue is addressed indirectly in the discussion of community stability. Chapter II of the Forest Plan states, "Produce forest goods and services in the most cost efficient way consistent with providing net public benefits. Generate revenues from permits, leases, user fees, and product receipts," (Page 4-2, Objectives). Alternative B meets the above Forest Plan direction.

Cumulative Effects
The Misery Lake Timber Sale, south of Ruby Creek County road is planned for fiscal year (FY) 2008 and the Blue Ruby Timber Sale, north of the Ruby Creek County road is planned for FY 2009. These projects would contribute to the overall Colville National Forest planned volume targets and fuel treatment targets.

Effects on American Indians

The Kalispel Tribe of Indians, Confederated Tribes of the Colville Reservation, and the Spokane Tribe of Indians were consulted, and no impacts to American Indian social, economic or substance rights are anticipated. No impacts are anticipated related to the American Indian Religious Freedom Act. Tribal members no doubt use the National Forest for recreation, religious purposes, and to gather forest products such as firewood and

huckleberries. Tribal members' use of this area of the National Forest would not be disproportionately affected when compared to other people for any of the alternatives considered with this project.

Effects on Consumers, Minority Groups, Women, Civil Rights and Environmental Justice

This section is based on information in the US Census and from personal communications with various ID team members. No adverse effects to consumers or civil rights were identified through the effects analysis.
The alternatives were assessed to determine whether they would disproportionately impact minority or low-income populations in accordance with Executive Order 12898. Approximately 18% of the people in Pend Oreille County have an income that is below the federal poverty level (US Census 2000). Low-income people no doubt use the National Forest for recreation and to gather forest products such as firewood and huckleberries. We have no evidence that low-income people use this area of the National Forest disproportionately when compared to other people.

Alternative B would reduce motorized access to portions of the analysis area through the proposed road decommissioning (see appendix B for a map with locations). It is expected that effects of any alternative would affect all users of this area equally. Any alternative selected would not disproportionately affect minority communities or low-income people.